Using Insight

Insight Version 2.2
IDL Version 5.2
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Chapter 1

Overview

This chapter includes information about IDL Insight™ (referred to simply as "Insight" in this document), IDL, the IDL documentation set, and about contacting Research Systems regarding problems with IDL.

About Insight

Insight is an application for *analyzing*, *visualizing*, and working with data in a variety of ways. Insight is written in the IDL language, and allows you to take advantage of IDL's computing environment —powerful, array-oriented language, mathematical analysis, and graphical display techniques —without having to deal directly with the IDL command line or be familiar with IDL's function set and command syntax.

Easy Data Management

Insight provides a graphical user interface that gives you the ability to visualize your data in many different ways, quickly and easily. Insight provides a *Data Manager* that helps you import data into Insight, either from IDL variables or from data files stored elsewhere on your computer system. The Data Manager allows you to keep track of your data easily, to

create new data items within Insight, and to perform simple data conditioning tasks (sorting, sampling, reformatting, etc.). See Chapter 3, “Working With Data” for more on Insight’s Data Manager.

Powerful Data Analysis

IDL provides a wide variety of data analysis routines, many of which are accessible through Insight’s interface. Insight dialogs allow you to “try out” different types of data analysis quickly and efficiently, without the need to write IDL programs or repeat commands. Insight’s data analysis capabilities are discussed in Chapter 6, “Analyzing Data”.

Once you’ve created a visualization in Insight, you can control many aspects of the visualization’s appearance — colors, line styles, even size and orientation — interactively, without the need to re-create the visualization after each change. See Chapter 5, “Working With Visualizations” for details.

The Insight Project: Data and Visualizations in a Convenient Package

Insight introduces the concept of a *project*. An Insight project is a special file that combines your data, visualizations, and any customizations of the Insight interface you may have made into a single compact unit. When you open a project that you’ve worked on previously, you can immediately pick up your work where you left off. Insight projects are perfect for sharing your data — and your analysis of your data — with other Insight users.

Insight project files use the file extension “`.ipj`”. Project files allow you to save:

- the configuration of windows,
- data items, stored in the *Data Manager*,
- visualizations,
- visualization *styles* (data-independent properties of a visualization, including things like color, line style and thickness, etc.).

You manage and save multiple Insight components together as a project. You can create, open, and save multiple Insight projects in the same Insight session. To find out how to use project components in more than one project, see “Sharing Data Among Projects” on page 15.

Moving Between Insight and IDL

Experienced users of IDL will find it easy to move back and forth between Insight’s graphical environment and the traditional IDL command prompt. Interaction between Insight and IDL is discussed in Chapter 8, “Insight’s IDL Interface”. You can even incorporate routines you’ve written in the IDL language into Insight, via the *PlugIn* mechanism. PlugIns are discussed in Chapter 9, “Extending Insight”.

About IDL

IDL is a complete computing environment for the interactive analysis and visualization of data. IDL integrates a powerful, array-oriented language with numerous mathematical analysis and graphical display techniques. Programming in IDL is a time-saving alternative to programming in FORTRAN, C, or C++—using IDL, tasks which require days or weeks of programming with traditional languages can be accomplished in hours. You can explore data interactively using IDL commands and then create complete applications by writing IDL programs.

Advantages of IDL include:

- IDL is a complete, structured language that can be used interactively to create sophisticated functions, procedures, objects, and applications.
- Operators and functions work on entire arrays (without using loops), simplifying interactive analysis and reducing programming time.
- Immediate compilation and execution of IDL commands provides instant feedback and "hands-on" interaction.
- Rapid 2D plotting, multi-dimensional plotting, volume visualization, image display, and animation allow you to observe the results of your computations immediately.
- Support for OpenGL-based hardware accelerated graphics.
- Many numerical and statistical analysis routines—including Numerical Recipes routines—are provided for analysis and simulation of data.
- IDL's flexible input/output facilities allow you to read any type of custom data format. Support is also provided for common image standards (including BMP, GIF, JPEG, and XWD) and scientific data formats (CDF, HDF, and NetCDF).
- IDL widgets can be used to quickly create multi-platform graphical user interfaces to your IDL programs.
- IDL programs run the same across all supported platforms (Unix, VMS, Microsoft Windows, and Macintosh systems) with little or no modification. This application portability allows you to easily support a variety of computers.
- Existing FORTRAN and C routines can be dynamically-linked into IDL to add specialized functionality. Alternatively, C and FORTRAN programs can call IDL routines as a subroutine library or display "engine".

IDL Documentation

IDL's *Online Help* system gives you access to the complete IDL documentation set in electronic, hypertext-linked format. You can enter the Online Help system by entering ? at the IDL command prompt or by selecting "IDL Help" from the Insight Help menu.

Research Systems provides a subset of the complete IDL documentation set in printed form along with your copy of the IDL software. We do not ship the full printed documentation set because some volumes cover specialized topics, which are of limited interest to some of our customers. Shipping only the volumes of greatest general interest in printed form allows us to provide the highest quality documentation set possible while minimizing the impact of our documentation on the environment. In addition to being available on-line, volumes not automatically shipped with new or upgrade orders are available for purchase; use the order sheet included with your shipment or consult your sales representative or distributor for details.

The IDL documentation set consists of the following volumes:

Using IDL

Using IDL explains IDL from an interactive user's point of view. It contains information about the IDL environment, the structure of IDL, and how to use IDL Direct Graphics to analyze your data.

Building IDL Applications

Building IDL Applications explains how to use the IDL language to write programs — from simple procedures to large, complex applications. It contains information on the structure of the IDL language, programming techniques, IDL Direct Graphics, and IDL's user-interface toolkit.

IDL Reference Guide

The *Reference Guide* is a two-volume set that contains detailed information about all of IDL's non-object-oriented procedures, functions, system variables, and commands. Information on IDL's object-oriented features and IDL Object Graphics is contained in IDL *Objects and Object Graphics*.

Object Graphics

Object Graphics contains information on IDL's object-oriented features, including a complete discussion of IDL Object Graphics. This volume also contains the complete reference to IDL's object class libraries.

Note Each of the above books includes a comprehensive index that covers all four volumes.

Using Insight

Using Insight (this book) contains information on IDL Insight, the graphical interface to IDL's analysis capabilities. Insight allows you to import, analyze, and visualize data without programming in the IDL language.

External Development Guide

The *External Development Guide* explains how to use IDL in concert with your computer's operating system or with programs written in other programming languages.

Scientific Data Formats

Scientific Data Formats contains detailed information about IDL's routines for dealing with Common Data Format (CDF), Hierarchical Data Format (HDF), Earth Observing

System extensions to HDF (HDF-EOS), and Network Common Data Format (NetCDF) files.

IDL DataMiner Guide

The *IDL DataMiner Guide* contains information on using IDL to interact with databases using the Open Database Connectivity (ODBC) interface.

Note The DataMiner option must be purchased separately.

IDL HandiGuide

The HandiGuide is a handy quick reference that contains calling-sequence information on all IDL routines.

Manual Organization

This manual tells you how to start and use the Insight application. We assume you:

- are familiar with graphical user interfaces,
- have a working knowledge of the operating system you are using,
- understand the operations and language associated with scientific data analysis, mathematical functions, and data types.

Using Insight is divided into the following chapters:

Chapter 1, "Overview" (this chapter) describes the organization of this manual and its intended audience; and tells you how to get help.

Chapter 2 "Getting Started" on page 11, tells you how to start Insight, guiding you through the dialogs for opening projects and importing data. You will learn how to share data among projects; set preferences; and use the File and Help menus.

Chapter 3, "Working With Data" on page 29, introduces Insight's Data Manager window and menu options and describes data *attributes*. You will learn how to use the Data Manager window's File, Edit, Condition, and View menus to work with data in various ways including importing, exporting, creating, and conditioning.

Chapter 4, "Visualizing Data" on page 49, describes visualization, and introduces the Insight Visualization window and its menubar and toolbar. You will learn how to use the Visualize menu to display data and the View menu to customize your view of data in the window.

Chapter 5, "Working With Visualizations" on page 67, explains how to work with visualizations in the Visualization window. You will learn how to specify *properties*, move and size visualizations, rotate surfaces, *annotate* visualizations, and use the Edit menu for such tasks as opening the Visualization Manager window and applying and saving styles.

Chapter 6, "Analyzing Data" on page 103, introduces data analysis with Insight and tells you how to use Analyze menu options to correlate data, fit curves, process images, and

smooth data. An advanced data calculator called the *formulator* is also described in this chapter.

Chapter 7, “Insight Tutorials” on page 163, provides broad examples, guiding you through common Insight operations. You’ll learn how to visualize data, modify properties, and perform several types of data analysis.

Chapter 8, “Insight’s IDL Interface” on page 187, describes the Insight routines you can use to invoke and interact with Insight from the IDL command line or from within a PlugIn. You should have a working knowledge of IDL to use these routines.

Chapter 9, “Extending Insight” on page 203, describes how you can add functionality to Insight by creating PlugIns. Detailed knowledge of Insight’s underlying code architecture is not required to build a PlugIn; however, PlugIn authors must have a working knowledge of IDL and follow the Insight PlugIn development guidelines.

Typographical Conventions

The following typographical conventions are used throughout the IDL documentation set:

- UPPER CASE
  IDL functions, procedures, and keywords are displayed in UPPER CASE type. For example, the calling sequence for an IDL procedure looks like this:

  CONTOUR, *Z [, X, Y*]

- Mixed Case
  IDL object class and method names are displayed in Mixed Case type. For example, the calling sequence to create an object and call a method looks like this:

  object = OBJ_NEW('IDLgrPlot')

  object -> GetProperty, ALL=properties

- *Italic type*
  Arguments to IDL procedures and functions — data or variables you must provide — are displayed in italic type. In the above example, *X*, *Y*, and *Z* are all arguments.

- Square brackets ([ ])
  Square brackets used in calling sequences indicate that the enclosed arguments are optional. Do not type the brackets. In the above CONTOUR example, *X* and *Y* are optional arguments. Square brackets are also used to specify array elements.

- `Courier type`
  In examples or program listings, things that you must enter at the command line or in a file are displayed in `courier` type. Results or data that IDL displays on your computer screen are shown in **`courier bold`** type. An example might direct you to enter the following at the IDL command prompt:

  ```
  array = INDGEN(5)
  ```

```
PRINT, array
```
In this case, the results are shown like this:

```
      0       1       2       3       4
```

Reporting Problems

We strive to make IDL and Insight as reliable and bug free as possible. However, no program with the size and complexity of IDL is perfect, and bugs do surface. When you encounter a problem with IDL, the manner in which you report it has a large bearing on how well and quickly we can fix it. This section is intended to help you report problems in a way that will help us correct the problem rapidly.

Background Information

When a bug is reported and verified, we correct it in a later release. Sometimes, a bug only occurs when running on a certain machine, operating system, or graphics device. For these reasons, we need to know the following facts when you report a bug:

- Your IDL installation number.
- The version of IDL you are running.
- The type of machine it is running on.
- The operating system version it is running under.
- The type and version of your windowing system.
- The graphics device, if the problem involves graphics.

The installation number is assigned by us when you purchase IDL. The IDL version, site number, and type of machine are printed when IDL is started. For example:

```
IDL. Version 5.1 (sunos sparc).
Copyright 1989-1998, Research Systems, Inc.
All rights reserved.  Unauthorized reproduction prohibited.
Installation number: 177.
Licensed for use by: ACME Datawhack Corp.
```
is the startup announcement from IDL version 4.0.1c under SunOS on a Sun SPARC workstation at installation number 177.

Under Unix, the version of the operating system can usually be found in the file `/etc/motd`. It is also printed when the machine boots. In any event, your system administrator should know.

Under VMS, the DCL statement:

```
write sys$output f$getsyi("version")
```
will give you the operating system version.

Under Windows 95 and Windows NT version 4, select “About” from the Help menu in the Windows Explorer. Under Windows 3.11 and Windows NT version 3.5, select “About” from the Help menu in the File Manager.

On the Macintosh, select “About this Macintosh” from the apple menu.

Double Check

Before reporting a problem, you should always ask yourself “Is it really a bug?” Sometimes, it is a simple matter of misinterpreting what is supposed to happen. Double check with the manual or a local expert.

If you cannot determine what should happen in a given situation by consulting the reference manual, the manual needs to be improved on that topic. Please let us know if you feel that the manual was vague or unclear on a subject.

It is often obvious whether something is a bug or not. If IDL crashes, it is a genuine bug. If however, it draws a plot differently than you would expect or desire, it might be a bug, but it is certainly less obvious. Another question to ask is whether the problem lies within IDL, or with the system running IDL. Is your system properly configured with enough virtual memory and sufficient operating system quotas? Does the system seem stable and is everything else working normally?

Describing The Problem

When describing the problem, it is important to use precise language. Vague terms like “crashes”, “blows up”, and “fails” are open to many interpretations. Does it really crash IDL and leave you looking at an operating system prompt? This would be our interpretation of “crash.” Perhaps, however, it just issues an unexpected error message and gives another prompt. What is really meant by a term like “fails?”

It is also important to separate concrete facts from conjecture about underlying causes. For example, a statement such as “IDL dumps core when allocating dynamic memory.” is not nearly as useful as one like “IDL dumps core when I execute the following statements. I think it might be trying to get dynamic memory”. The second version tells us exactly what happened. The opinion about what was going on when the problem surfaced is also useful to us, but it helps to have it clearly labeled as such.

Reproducibility

Intermittent bugs are by far the hardest kind to fix. In general, if we can’t make it happen on our machine, we can’t fix it. It is therefore far more likely that we can help you if you can tell us a sequence of IDL statements that cause the problem to happen. Naturally, there are degrees of reproducibility. Situations where a certain sequence of statements causes the bug 1 time in 3 tries are fairly likely to be fixable. Situations where the bug happens once every few months and no one is sure what triggered it are almost hopeless.

Simplify the Problem

When reporting a bug, it is important to give us the shortest possible series of IDL statements that cause it. The longer and more intricate an example, the less likely it is that we can help. Sometimes a single statement triggers the bug. Often though, the problem surfaces when writing a larger system of inter-related procedures and functions. Such a situation must be simplified before we can begin to work on it. Take the following steps to simplify your problem:

- Copy the procedure and function files that are involved to a scratch second copy. Never modify your only copy!
- Eliminate everything that is not involved in demonstrating the bug. Don't do this all at once. Instead, do it in a series of slow careful steps. Between each step, stop and run IDL on the result to ensure that the bug still appears.
- If a simplification causes the bug to disappear, restore the statements involved and look for other things to eliminate.
- If the problem does not involve file Input/Output, strive to eliminate all file I/O statements. Use IDL routines to generate a dummy data set, rather than including your own data. If your bug report does not involve I/O, it will be much easier for us to reproduce. If you have to provide us with a copy of your data, things become more complicated.

  On the other hand, if the bug involves file Input/Output, attempt to determine if the problem only happens with a certain file, or with any data. If you are running under VMS, check the file organization using the DCL `DIRECTORY/FULL` command, and include this information in your report.

  The end result of such simplification should be a small number of IDL statements that demonstrate the problem.

Bugs with Dynamic Loading

Under some operating systems, the CALL_EXTERNAL and LINKIMAGE system routines allow you to dynamically load routines written in other languages into IDL. This is a very powerful technique for extending IDL, but it is considerably more difficult than simply writing IDL statements. At this level, the programmer is underneath the user level shell of IDL and is not protected from small programming errors that can corrupt data, give incorrect results, or even crash IDL. In such situations, the burden of proving that a bug is within IDL and not the dynamically loaded code is entirely the programmer's.

Although it is certainly true that a bug in this situation can be within IDL, it is very important that you exhaust all other possibilities before reporting a bug. If you decide that you need to report a bug, the comments above on simplifying things are even more important than usual. If you send us a small example that explains the bug, we can respond quickly with a correction or advice. Otherwise, we may not even know where to begin.

Sending Data with Your Bug Report

If the statements required to reproduce the bug are more than a few lines or require data files, we will need you to send them to us on magnetic media or via e-mail. Call us for details.

Contact Us

Note To report a problem, contact us at the following addresses.

Mail

Research Systems, Inc.
4990 Pearl East Circle
Boulder, Colorado 80301

Telephone

(303) 786-9900 (Voice)
(303) 786-9909 (Fax)
(303) 413-3920 (IDL technical support direct line)

Electronic Mail

`support@rsinc.com`

Chapter 2

Getting Started

The following topics are covered in this chapter:

Starting The Insight Application 12
The Insight Interface 16
Managing Projects: The File Menu 19
Other Visualization Window Menus..... 22
Setting Insight Preferences..... 22
Getting Help 27

This chapter tells you how to start Insight, guiding you through the dialogs for opening projects and importing data. You will also learn how to share data among projects, set preferences, and use the File and Help menus.

Starting The Insight Application

If you plan to use Insight frequently from IDL, you may wish to have the needed routines loaded during IDL startup (see "LIVE_LOAD").

Start Insight by double-clicking on the Insight icon (Windows and Macintosh systems) or by entering `insight` at the Unix shell or VMS DCL prompt. You also can start Insight by entering `insight` at the IDL command prompt (all systems).

Note In Windows, starting Insight without first starting IDL runs Insight in *runtime mode*. This means that even though IDL is running (IDL must be running for Insight to run), you will not have access to the IDL Development Environment or the IDL command prompt. It also means that PlugIns stored in IDL `.pro` files will not be loaded. PlugIns that are stored in IDL `.sav` files will be loaded. See "General Guidelines for Writing PlugIns" on page 205 for more on PlugIns.

For additional information on how to specify command-line parameters when starting Insight, see "INSIGHT" on page 189.

After you start the application, the first thing you'll do is open a new or existing *project*. If you're creating a new project, you'll also have the chance to immediately import *data*. Insight makes these tasks easy by presenting dialogs that allow you to select the from a list of available options. The first dialog that appears is the Getting Started With Insight dialog. This dialog *only* appears after you start Insight.

The Getting Started With Insight Dialog

Use the Getting Started With Insight dialog (shown in Figure 2-1) to open a project right after you start Insight. Insight displays project options in the list on the left-hand side of the dialog.

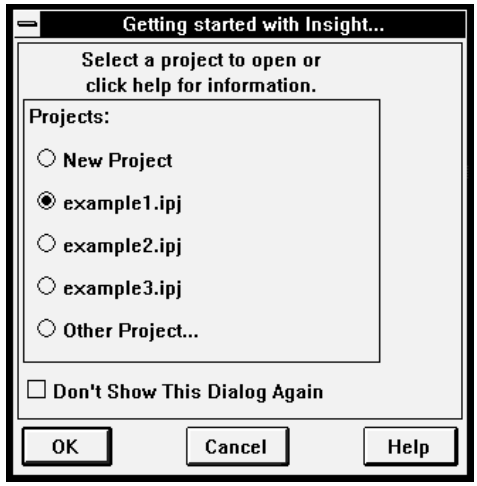


Figure 2-1: Getting Started With Insight Dialog

Note Select the "Don't Show This Dialog Again" option if you don't want the Getting Started With Insight dialog to appear the next time you start Insight.

Hint The first time you start Insight, you might want to open an *example project*. Example projects contain data (listed in the Data Manager window), *visualizations* (displayed in the Visualization window), and *styles*. Opening an example project will give you a feel for what an Insight project looks like and how it works.

Select a project in one of the following ways:

- Click on one of the listed projects. By default, the dialog displays the three most-recently saved projects. Click "OK" to confirm your selection and open the project.
- If the desired project is not listed, select "Other Project..." to open a file selection dialog. Select a project file (a file with an `.ipj` extension) and click "OK".
- To open a new project, select "New Project" and click "OK". Insight automatically opens the Select Data to Import Dialog, allowing you to import data into your new project file.

  After you select a project, the Visualization window appears on the screen. The Data Manager window also may appear (if the project was saved with the Data Manager window open).

The Select Data To Import Dialog

Use the Select Data to Import dialog (shown in Figure 2-2) to import data into a new project. You can import the following types of data:

- Files of "known" file types. By default, Insight "knows" about several different standard image file formats (TIFF, JPEG, etc.). File formats are also "known" if a File PlugIn has

been created to read the file format and placed in the PlugIns path. Some File PlugIns are included with Insight, such as one to read binary data files with the extension .dat.

- Data stored in ASCII format files.
- IDL variables, created within the current IDL session.

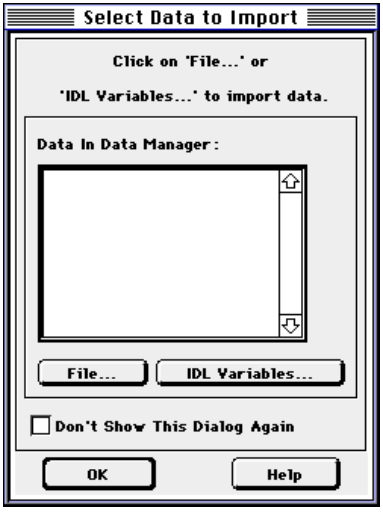


Figure 2-2: Select Data to Import Dialog

File

To import a file with a known format, click “File...”. This opens an operating system native file selection dialog. Select your file and click “OK”. If Insight does not recognize the file extension of your file, it will present you with a list of supported file formats in the Select File Format for Import dialog (see “Import File Menu Option” on page 36). If your file is one of the supported types, select the file type and click “OK”.

If your file is one of the supported types, select the file type and click “OK”. If it is an ASCII file format that isn’t supported yet, select “Define and Read ASCII...”. Otherwise, you will need to either convert it to a supported type or create an Insight “File PlugIn” to read the file. For more information, see “Import File Menu Option” on page 21, “Import File As Menu Option” on page 21, or“File PlugIns” on page 206.

IDL Variables

To import an IDL Variable, click “IDL Variable...”. This opens the Import IDL Variables dialog. Any variables that have been created in the current IDL session will be listed in the dialog. Select the variables you wish to import and click “OK”. (You can also use IDL commands to place IDL variables into Insight. See “INSPUT” on page 194 for details.)

After selecting files and/or IDL variables as desired, click “OK” in the Select Data to Import dialog.

Note Select the "Don't Show This Dialog Again" option if you don't want the Select Data to Import dialog to appear the next time you start Insight with a new project.

You can import data into Insight at any time by selecting "Import File...", "Import File As...", or "Import IDL Variables..." from the Insight File menu. If a duplicate file name exits, you will be prompted with a Duplicate Data Name dialog. Select one of the three options from the dialog.

Duplicate Data Name
A data item named "Boola Data" already exists in the Data Manager.
Do you wish to:
Replace the Data Item's Value
Replace the Data Item
Use Unique Name "Boola Data 001"
OK
Cancel
Help

Sharing Data Among Projects

Insight associates data imported during a session only with the current project. If you want to use the same data in other projects, you have a few options:

- You can use the Organizer to copy Insight data between projects. See the "Organizer" on page 71.
- You can export data in a file format recognized by Insight. Then you can import the data into another Insight project using that project's import menu options.

Note You can import or export a file with a file format other than standard IDL formats by writing a *File PlugIn* that handles the desired file format. See "File PlugIns" on page 206.

- You can use the "Save Project As..." menu option to save the project with a new project name. The additional project will contain the same data as the original. See "Save Project As Menu Option" on page 20.
- You can use the IDL routine INSGET to convert Insight data items into IDL variables, and the INSPUT routine to convert IDL variables into Insight data items. See "INSPUT" on page 194 and "INSGET" on page 191.

After Opening a Project

After you have selected a project to open or imported data into a new projects, the Insight Visualization window associated with the selected project appears. For a description of this window, see "The Visualization Window" on page 50. This is the project's main window and your primary working area. In this window, you will save changes to the project, open additional projects, close the current project, and exit Insight. Using the Visualization window's menu and toolbar options, you can work with data in a variety of ways and navigate to all components of the project, including the Data Manager window. If you have opened an existing or example project, the Data Manager window also may appear, depending on the project. Insight lists all project data in the Data Manager window. For a description of the Data Manager window and to find out how to work with data items, see "Working With Data" on page 29.

Note At the start of a new session, you might want to set your Insight *Preferences*. See "Preferences Menu Option" on page 22 or "Setting Insight Preferences" on page 22 to find out how.

The Insight Interface

This section describes how to work with Insight's windows, dialogs, and other interface features. The main Insight interface screen is shown in Figure 2-3.

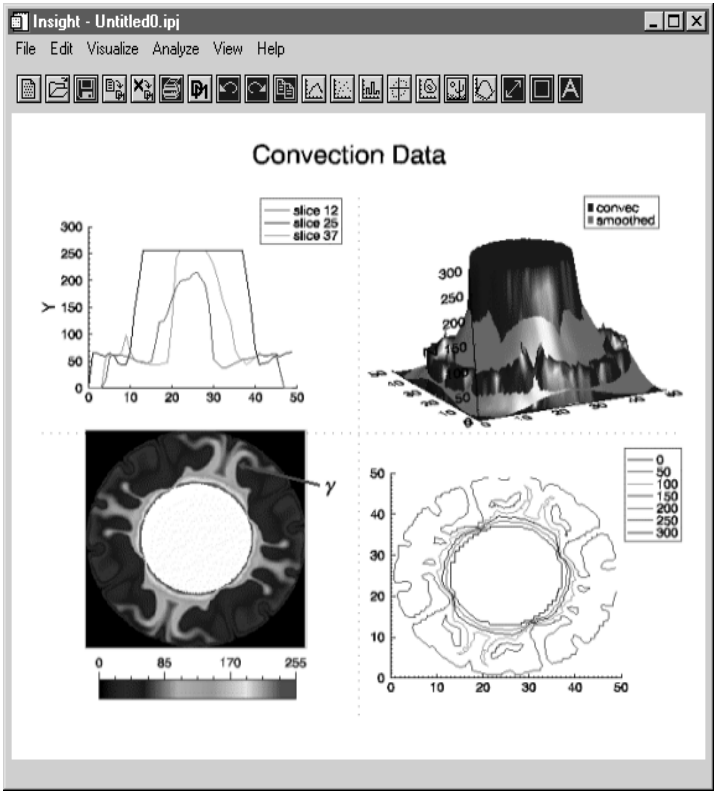


Figure 2-3: The Insight Interface: the main windc demonstrating several visualizations.

Note The figures in this manual depict Motif, Microsoft Windows, and Macintosh windows and dialogs. The dialogs and windows for all three systems operate in a similar fashion. For more detail on using windows and dialogs for your operating system, see your system user's manual.

Standard Insight Dialog Buttons

Several buttons appear in all (or most) Insight dialogs. Since buttons look different on each platform, your buttons may not look like the examples shown in this manual. However, they operate the same whenever they appear in Insight.

OK

Clicking “OK” permanently carries out an action, or actions, or saves modifications specified in the dialog and closes the dialog. In Analyze dialogs, clicking “OK” also generates or replaces a data item (or its value), which is stored in the Data Manager.

Help

Clicking “Help” opens Insight’s Online Help system to get information on the dialog and its components.

Apply

The Apply button appears on some dialogs. Clicking “Apply” carries out an action on a “trial” basis. This option is helpful when you want to “try out” various options before making them “permanent.” You can click “Apply” as many times as you wish. When you’re ready to make “permanent” data or visualization changes, click “OK”.

Cancel

Clicking “Cancel” cancels any modifications you’ve entered (or applied) and closes the dialog.

More >>

Clicking More >> expands the dialog, providing additional dialog options.

<< Less

Clicking << Less closes the expanded section of the dialog that appeared when you clicked More >>.

Entering File Paths

Selecting or saving files sometimes requires entering file paths in a dialog’s text field. Each platform requires paths to be entered in a different way. For more detail on how to enter paths on your operating system, see your system user’s manual.

Data Browsers

A number of Insight dialogs include “Browse...” buttons. Clicking “Browse...” opens an Insight data browser, which allows you to select one (or sometimes several) Insight data items for use in the current operation. When you click the browser’s “OK” button, Insight uses the data as if you had provided the data name yourself.

Standard Insight Dialogs

A number of dialogs are used in multiple places in Insight. This section describes these general purpose dialogs.

Project Browser Dialog

If more than one project is open, this dialog will open to let you choose which project to interact with (e.g., to import data into with INSPUT, or export data out of with INSGET). To select a project, click on its name and hit the OK button, or simply double-click on the name.

Note This dialog will not appear if Insight already knows which project you are interacting with, e.g., if you are using a menu option on a specific project.

Data Browser Dialog

This dialog lets you choose one or more data items from the current project. In some cases you will only be permitted to choose one item (such as in Analysis dialogs and the Formulator); in others (like from INSGET) you can choose multiple items, and will have the following additional buttons:

- All - Select all data items.
- None - Deselect all data items.

Double-clicking on a data item does an implicit "OK".

Note The choices shown in the browser are not necessarily all of the data items in the project's Data Manager, e.g., if only vectors are appropriate for the given situation, all other data will have been filtered out.

Import IDL Variables Dialog

This dialog lets you choose variables from the IDL command line to import into Insight. Double-clicking on a variable does an implicit "OK".

- All - Select all variables.
- None - Deselect all variables.

Duplicate Data Name Dialog

This dialog lets you choose what to do if a resultant data name of some action is already in use by another data item in the project. In addition to canceling the action with the Cancel button, you will have the following options:

- Replace the Data Item's Value - Replaces the *value* of an existing data item of the same name. This will result in dynamic updating of any current uses of that item, where possible. For example, a visualization would automatically attempt to redraw using the new value.
- Replace the Data Item - Replaces the data item, i.e., the old data item will be deleted and a new one will be created. Future use of the old item will no longer be possible. For example, if an old item was being visualized, you would loose the ability to edit its properties.
- Use Unique Name "XYZ" - The unique (unused) name displayed will be given to the new data item.

Duplicate Color Table Name Dialog

This dialog lets you choose what to do if a resultant color table name from some action is already used by a color table in the project's Color Manager. In addition to canceling the action with the Cancel button, you will have the following options:

- Replace the Color Table's Value - The existing color table will be replaced by a new one (i.e., the old table will be deleted and a new one created).
- Replace Color Table - The value of the existing color table will be replaced. This will cause dynamic updating to occur for any current uses, e.g., an image visualization would update to reflect the new value.
- Use Unique Name "XYZ" - The unique (unused) name displayed will be given to the new color table.

Managing Projects: The File Menu

Insight groups project management options in the File menu of the Visualization window. Using the File menu, you can open projects, save the current project, import data files, export visualizations and windows, import IDL variables, print the contents of the Visualization window, specify page set up, open the Data Manager window, set preferences, and exit the Insight application.

Note Many menu items in the Visualization window menus are also accessible from the visualization toolbar. See "Insight Toolbar" on page 51 for details.

New Project Menu Option

Select "New Project" from the File menu to create a new Insight project. A new Visualization window will open.

New projects take on the characteristics of a *template* file named `insight22.ipj` (`.insight22.ipj` on Unix systems), where "22" refers to the version number of Insight (this is Version 2.2). You can use the template file to ensure that data and *styles* (combinations of characteristics that define how individual visualization elements appear) you want to appear in every project are included when you open a new project.

Template files are similar in content to other project files, but have a special name, location, and internal format. Any project file may be used as the template; simply give it the appropriate name and location. If necessary, Insight will convert it to the proper format and back up the original file with extension `ibk`.

On Windows and Macintosh systems, the template file is stored in the hook subdirectory of the IDL `lib` directory. On Unix and VMS systems, the template file is stored in your home directory.

If you alter or replace the `insight22.ipj` file, all new projects you create from then on will take on the characteristics of the new template file.

Note Template files for Insight Version 1.0 were named insight.ipj. Old template files existing in home directories will remain untouched to permit uninterrupted use of previous versions of Insight.

Note If a regular project file from a previous version of Insight is opened and then saved, it will automatically be converted to the new format. The original file will be backed up with extension i##, where ## is the Insight version number without the decimal point (e.g., i10 for Version 1.0).

Open Project Menu Option

Select "Open Project..." to open a file selection dialog that displays a list of existing Insight projects (designated by the `.ipj` extension). Select a project in this dialog and click "OK".

Close Project Menu Option

Select "Close Project" to close the current Insight project if you have more than one project open. You will be prompted to save any changes to the file. All data imported into a project will remain associated with a saved project. The next time you open the project, it will appear as it did when you closed it. For example, if both the Visualization window and the Data Manager window are open when you saved and closed, the next time you open the project, both windows will be opened.

Note If you have only one project open, this option is not available. Use the "Exit" menu option instead.

Save Project Menu Option

Select "Save Project" to save a new project or save changes to an existing project.

- When you are saving changes to an existing project, selecting the "Save" option simply saves the changes.
- When you are saving a new project, selecting the "Save" option opens a file selection dialog that allows you to name the project and select a directory in which the new project should be saved. Project files should be saved with an `.ipj` file extension.

Save Project As Menu Option

Select "Save Project As..." to open a file selection dialog that allows you to name (or rename) the project and select a directory in which the project should be saved. Project files should be saved with an `.ipj` file extension.

Export Menu Option

Select "Export..." to export a visualization or window. When you choose the "Visualization" or "Window" submenu, a dialog will pop up that allows you to name (or rename) the exported file and set various attributes of the file. The exported file will have

the extension `.gif`, `.jpg`, `.bmp`, etc. For more information, see “Export File Menu Option” on page 34.

Import File Menu Option

Select “Import File...” to import a data file. A file selection dialog opens; select the file you wish to import and click “OK”. If Insight recognizes the file extension (`.gif`, `.jpg`, etc.), it will automatically import the file. If it does not recognize the file extension, it will open the Select File Format for Import dialog, allowing you to choose a file format. For more information on importing files, see “Import File Menu Option” on page 36.

Note You can import a file with a file format other than standard IDL formats by writing a File PlugIn that handles the desired file format. See “File PlugIns” on page 206. Once you have added a File PlugIn to Insight that complies with the PlugIn guidelines, Insight will recognize the file format and add it to the list of available file formats.

Import File As Menu Option

Select “Import File As...” to import a data file. The only difference between this option and “Import File” is that choosing “Import File As...” will always prompt you with the Select File Format for Import dialog.

Import IDL Variable Menu Option

Select “Import IDL Variables...” to open the Import IDL Variables dialog, which allows you to import one or more IDL variables into the project. Any variables that have been created in the current IDL session will be listed in the dialog. Select the variables you wish to import and click “OK”. (You can also use IDL commands to place IDL variables into Insight. See “INSPUT” on page 194 for details.)

Print Menu Option

Select “Print” to open an operating-system native Printer Setup dialog which allows you to print the contents of the Visualization window. Settings in this dialog depend on the printer driver installed on your system.

Note See “Preferences Dialog: General” on page 22 for information on printing preferences.

Page Setup Menu Option

Select “Page Setup” to open an operating-system native Page Setup dialog, which allows you to specify how the page should appear when printed. Settings in this dialog depend on the printer driver installed on your system (Mac only).

Data Manager Menu Option

Select “Data Manger...” to open the Data Manager window. The Data Manager window displays the names and attributes of available data in the project. For a description of the Data Manger, see “Working With Data” on page 29.

Preferences Menu Option

Select “Preferences...” to open the Preferences dialog, which allows you to specify settings that Insight retains from session to session. Use this dialog to customize general Insight features, menu display, and specify the Preferences file and PlugIns directory. When you select a category from the Category droplist, the unique options associated with that category appear. See “Setting Insight Preferences” on page 22 for help using the Preference dialogs.

Exit Menu Option

Select “Exit” to exit the Insight application. You will be prompted to save changes to all any open projects.

Caution Do not exit IDL before exiting Insight. If you do this, changes you’ve made to open projects may be lost.

Other Visualization Window Menus

The Visualization window is described in Chapter 4, “Visualizing Data”. Chapter 5, “Working With Visualizations”, describes the Edit menu. Chapter 4, “Visualizing Data”, describes the Visualize menu and View menu. Chapter 6, “Analyzing Data”, describes the Analyze menu. The Help menu is described in “Getting Help” on page 27.

Setting Insight Preferences

This section describes categories and options in the Preferences dialog, which opens when you select “Preferences...” from the File menu. Insight preferences are stored in a file named `insight22.prf` (or `.insight22.prf`, on Unix systems) in the same directory as the `insight22.ipj` template file.

Note Preference files for Insight Version 1.0 were named insight.prf. Old preference files existing in home directories will remain untouched to permit uninterrupted use of previous versions of Insight.

Preferences Dialog: General

Select the “General Customization” option from the Category droplist to specify general preferences. The General Customization options (shown in Figure 2-4) appear.

Show Startup Dialogs

From the “Show Startup Dialogs” panel, select dialogs you want to see every time you start Insight. For example, if you want the Getting Started dialog to appear every time you start Insight, select the “Getting Started” option.

Note If you specify a project file name via the PROJECT_FILE keyword when you start Insight, the “Getting Started” dialog will not be displayed even if you have set the preference to show it.

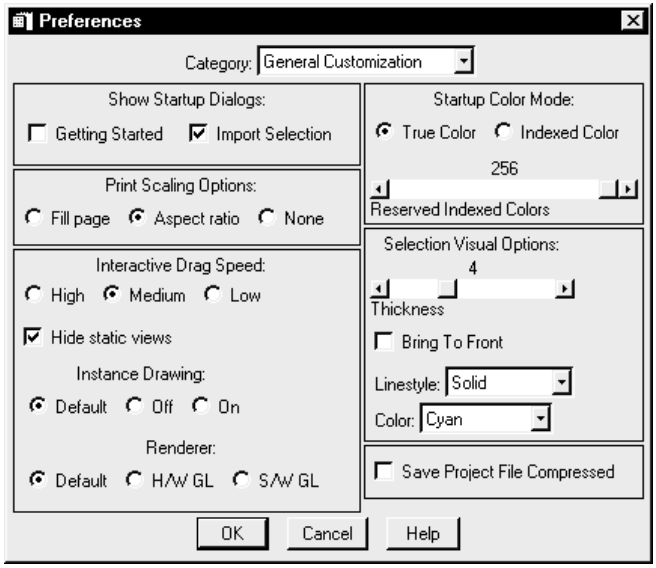


Figure 2-4: Preferences Dialog with General Customization Options

Print Scaling

From the “Print Scaling Options” panel, select “Fill page”, “Aspect ratio” or “None”. These options describe how visualizations in the window will correspond to the printed page.

- Select “Fill page” to restrict or expand the contents of the Visualization window to the paper size specified for printing.
- Select “Aspect ratio” to fill the page with all the visualizations and maintaining the aspect ratio. Insight must scale the window contents which diminishes image accuracy.
- Select “None” so that the contents of the Visualization window appear on paper just as in the window. The visualizations are not sized to fill the page. If they are larger than the page size, the visualizations will be clipped.

Interactive Drag Speed

From the “Interactive Drag Speed” panel, select “High”, “Medium”, or “Low” visualization drag speed. The higher the speed, the lower the drawing quality of the visualization while dragging. This setting does not affect the quality of the visualization when you are not moving it interactively with the mouse.

Hide Static Views Checkbox

When “Hide Static Views” is selected, visualizations that are not being manipulated will not be drawn during the manipulation.

Instance Drawing/Renderer Buttons

Instance Drawing allows Insight to store the unchanging portion of the visualization and only redraw the dynamic (changing) graphics. Because of overhead involved in creating the instance, this technique is more effective with complex visualizations. When using software rendering, instancing is almost always worthwhile. If your system uses hardware rendering, you may wish to leave Instance Drawing unchecked.

You may want to experiment with software rendering even if your system supports hardware rendering; in many cases, Insight will run faster using software rendering and instance drawing than using the operating system's native rendering methods.

The "Default" option for Rendering means to use the rendering option specified in the IDE (IDL Development Environment); if the IDE is not running, however, the default is hardware rendering. For more information, see "Hardware vs. Software Rendering" in the *Objects and Object Graphics* manual.

The "Default" option for Instance Drawing means to turn on instancing if and only if software rendering is on. For more information, see "Instancing" in the *Objects and Object Graphics* manual.

Startup Color Mode

Select either the "True Color" or "Indexed Colors" option. A True Color image contains the R,G,B values of your data. An Indexed Color image contains indexes into a color table, which contains the R,G,B information.

Reserved Indexed Colors Options

Move the "Reserved Indexed Colors" slider to the desired number of reserved colors (1 through 256). This option works only when you're running Insight in Indexed Color mode. (See "INSIGHT" on page 189 for additional information on starting Insight in different color modes.)

Selection Visual Options

Adjust the line thickness, style, and color of the lines used to highlight a selected visualization element using the controls in this section of the dialog. Select the "Bring to Front" checkbox to bring the particular visualization to the front of all the others.

Save Project File Compressed Checkbox

Check this box so that normal (non-template) project files will be saved in compressed format.

When you have finished selecting options, you can select another category from the "Category" droplist to continue setting preferences. When you have finished setting preferences in all desired categories, click "OK".

Preferences Dialog: Clipboard

Select the "Clipboard Customization" option from the Category droplist to specify clipboard preferences. The Clipboard Customization options (shown in Figure 2-5) appear.

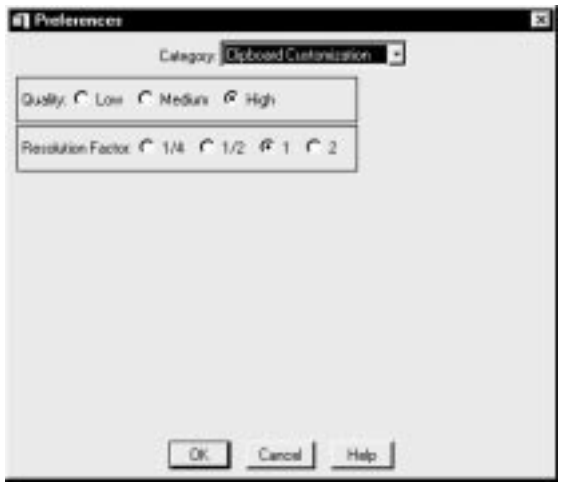


Figure 2-5: Preferences Dialog for Clipboard Customization

Quality

The rendering quality at which graphics are drawn to the clipboard. The default is High.

Resolution Factor

The resolution of the graphics drawn to the clipboard as compared to screen resolution (i.e., 1/2 means the clipboard has half the resolution as the screen). The default is 1.

Preferences Dialog: Menu Display

Select the "Menu Customization" option from the Category droplist to specify menu preferences. The Menu Customization options (shown in Figure 2-6) appear. Select "Visualization Window" or "Data Window" from the "Menubar of" droplist to select menubar options for one window or the other.

To show or hide specific menu options, select or unselect the options in the scrolling list. To show all menu options in the Visualization or Data Manager window, click the "Show All" button. Your changes will take effect the next time you start Insight.

When you have finished selecting options, click "OK". The dialog closes and a Question dialog appears giving you the option to restart Insight immediately. For these preference changes to take effect, you must restart the Insight application.

Preferences Dialog: PlugIns Path

Select the "PlugIns Customization" option from the Category droplist to specify the path where Insight should search for PlugIns. The PlugIns Customization options (shown in Figure 2-5) appear. By default, this path is set to the `plugins` subdirectory of the

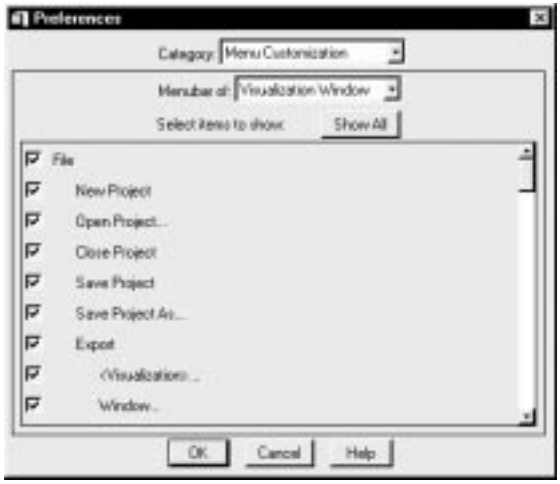


Figure 2-6: Preferences Dialog with Menu Customization Options

`insight` subdirectory of the `examples` directory in the IDL distribution. A number of example PlugIns are included in this directory.

Figure 2-7: Preferences Dialog for Specifying the PlugIns Path

- Click “Add” to add a directory to the list.
- Click “Remove” to remove a directory from the list.

- Click “Move Up” to move a directory up one in the list.
- Click “Move Down” to move a directory down one in the list.

  Insight will search for all `.pro` and `.sav` files in the directories from top to bottom in the list. If both a `.pro` and a `.sav` file exist for the same PlugIn in a given directory, the `.pro` file will be used. If a given PlugIn exists in multiple directories, it will be ignored in all but the first directory in which it is located.

Note All of the `.pro` and `.sav` files in the PlugIns path must be PlugIns.

Preferences Dialog: Preference File

Select the “Preference” option from the Category droplist to specify the file to which Preferences will be written. The Preferences Customization options (shown in Figure 2-8) appear.

Figure 2-8: Preferences Dialog for Specifying the Preference File

Select the Preference file in one of the following ways:

- Enter a filename in the “Preference File” text field; or
- Click “Browse” to open a file selection dialog. Select a file in the normal way.

Getting Help

Insight provides several ways to get information on various Insight topics. You can access the online help system by:

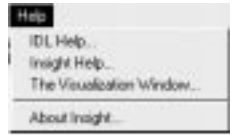
- clicking the “Help” button in dialogs

- selecting an option from Insight's Help menu
- entering **?** at the IDL command prompt

You also can refer to the printed Insight and/or IDL documentation.

IDL Help

Select "IDL Help" to open the IDL online help files. IDL's Online Help system gives you access to all volumes of the IDL documentation set in electronic, hypertext-linked format.



Insight Help

Select this option to open the Insight online help files.

The Visualization Window Menu Option

This option appears when you're working in the Visualization window. Select this option to get information on Insight's Visualization window.

The Data Manager Window Menu Option

This option appears when you're working in the Data Manager window. Select this option to get information on Insight's Data Manager window.

About Insight

Select this option to open a dialog which displays the Insight and IDL versions you are using. Click "OK" to close the dialog.

Chapter 3

Working With Data

The following topics are covered in this chapter:

The Data Manager Window 30
The Data Manager Window Menubar ... 30
Data Attributes Overview 31
Saving in the Data Manager Window 33
Importing and Exporting Data 34
Reading ASCII Format Files 37
Editing and Creating Data 37
Viewing Data 42
Conditioning Data 44

This chapter introduces Insight's Data Manager window and menu options and describes data *attributes*. You will learn how to use the Data Manager window's File, Edit, Condition, and View menus to work with data in various ways including importing, exporting, creating, and conditioning.

The Data Manager Window

The *Data Manager window* (shown in Figure 3-1) is your view of the Insight data area associated with the Insight project. Basically, it's a list of data items with specific information about each, called *attributes*. To open the Data Manager window, select the "Data Manager..." option from the File Menu in the Visualization window. As a shortcut, you can click the "Data Manager" button in the Visualization Toolbar (the button displays the letters "DM"). The Data Manager window displays a table listing the attributes of data items which have been imported or created for the project. Insight lists data names in row headers with attributes displayed in columns to the right.

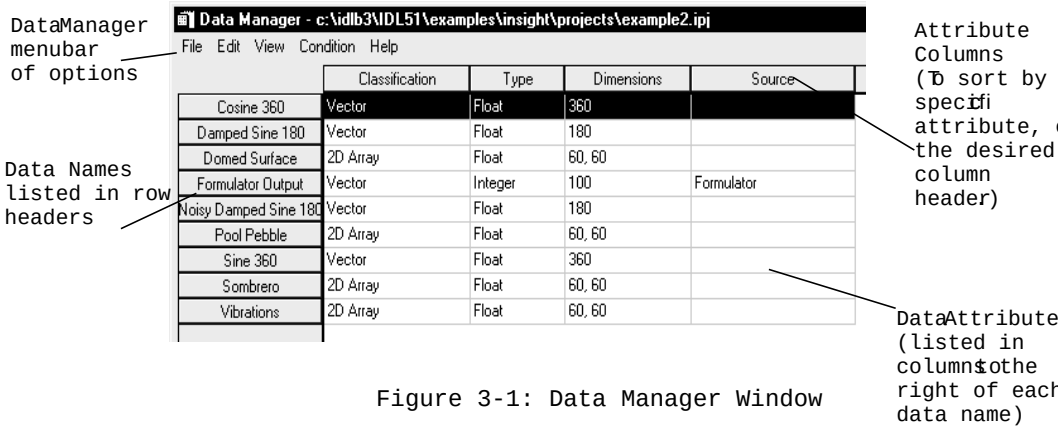


Figure 3-1: Data Manager Window

The Data Manager Window Menubar

The menubar across the top of the Data Manager window has five main menus: File, Edit, View, Condition, and Help. When you select a menu option that is followed by an ellipsis (...), Insight opens a dialog or window so you can enter more information or select options before performing an operation. The operations you can perform include:

- customizing your view of data and attributes,
- creating, importing, and exporting data,
- conditioning existing data,
- viewing and modifying attributes of existing data,
- viewing data values.

Data Attributes Overview

Insight organizes the information describing data as a set of attributes. Examples of attributes are name, classification, type, dimensions, elements, and description. This section describes the data attributes used by the Insight Data Manager.

Note To modify one or more attributes of a data item, select the data item from the Data Manager's table, then select "Attributes..." from the Edit menu in the Data Manager window. To view the value of selected data, select "Value..." from the Edit menu of the Data Manager window.

When you create new data items within Insight, you assign the attributes explicitly. For example, when you select "Create Data" from the Edit menu in the Data Manager window, a dialog (shown in Figure 3-2) allows you to specify attributes for your data. When you import data, Insight determines most data attributes for you.

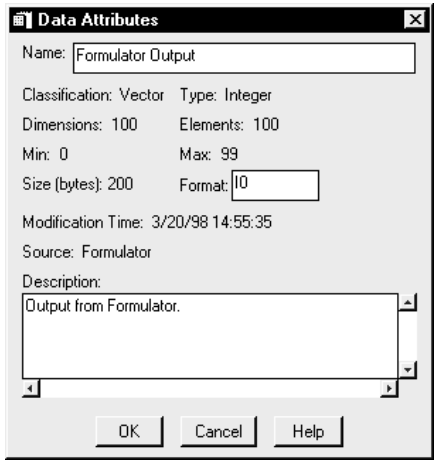


Figure 3-2: Data Attributes Dialog

Data Attributes

This section describes the attributes associated with data.

Name

This attribute contains the name of the data. Data created in Insight has a name assigned by you or by Insight. Names must start with a letter but can include letters, numbers, underscore characters, or single spaces.

Note If you do not choose to name your data, Insight uniquely names new data based on data type and sequence.

Classification

This attribute displays the classification of the data. Insight classifies data as a type of variable: Scalar, Vector (a one-dimensional array), Arrays (2D through 8D), or Image.

Type

This attribute contains the type of data. Each data item has one of the following data types:

Byte	Unsigned integers from 0 to 255.
Integer	Integers from -32768 to +32767.
Long	Integers from -2^{31} to 2^{31} -1.
Float	32-bit, single-precision, floating-point number in the range of $\pm 10^{38}$(IEEE)
Double Float	64-bit, double-precision, floating-point number in the range of $\pm 10^{308}$(IEEE)
Complex	A real, imaginary pair of floating-point numbers.
Double Complex	A [*real*, *imaginary*] pair of double-precision numbers.
String	A sequence of 0 to 32,767 characters.

Table 3-1: Insight Data Types

Dimensions

This attribute contains the number of elements in each dimension of the data. The column contains one number for a vector and two to eight numbers for an array. For example, the “Dimensions” column contains “60, 60” for a two-dimensional array with 60 elements by 60 elements.

Elements

This attribute contains the total number of elements in the data item. Basically, the total is the product of all of its dimensions. For example, the “Elements” column will contain the number “3600” for a two-dimensional array with 60 elements in one dimension and 60 in the other.

Description

This attribute contains the description of the data item. If the data was generated in an Analyze dialog, this field also lists the options you selected in that dialog.

Modification Time

This attribute contains the date and time of the last modification.

Source

This attribute contains the source of the data. The source is one of:

- "Project <*filename*>" if the data item was copied via the Organizer.
- "File <*filename*>" if the data item was imported into Insight from a file.
- "Insight Command" if the data came through an argument to the INSIGHT command.
- "Analysis <*modulename*>" if the data item was created by an Analysis module.
- "InsPut" if you used the INSPUT function from the IDL command line to import the data.
- "Insight Create" if you created the item in the Data Manager window.
- "Formulator" if you created the item with the Formulator.

Size
This attribute contains the number of bytes in the data.

Value
This displays the value of the selected data.

Min
This is the minimum value of the data.

Max
This is the maximum value of the data.

Order
This option contains the display order for image data.

Color Table
This option contains the name of the color table for image data.

Format
This allows the user to enter a format string (minus parentheses) which is then used as the default format for displaying data values textually.

Saving in the Data Manager Window

Data is just another part of the Insight project; select "Save Project" or "Save Project As..." from the Visualization window's File menu to save newly created or imported data items

Hint As a shortcut you can use the Save button from the Insight Toolbar, which is described on page 51.

Importing and Exporting Data

Insight groups the Data Manager window's data input and output options in the Data Manager File menu. Using this menu, you can import and export data files, import IDL variables, and close the Data Manager window.

Note You also can import files and IDL variables using import menu options in the File menu in the Visualization window.

Export File Menu Option

After choosing a file from the Data Manager, select "Export File" to export the file as one of the formats listed (JPEG, TIFF, GIF, etc.). A file Export dialog will open.

Note The availability of the following options depends on the file type chosen.

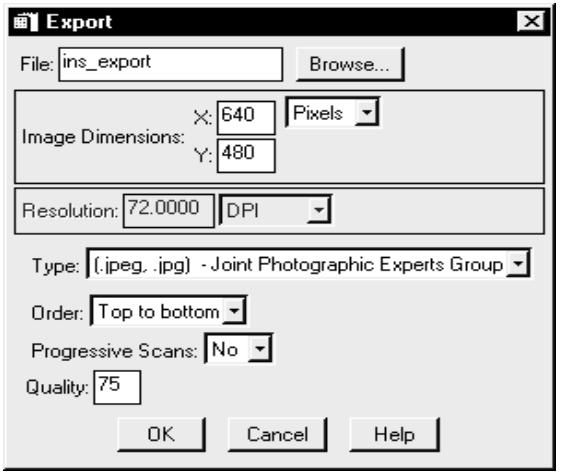


Figure 3-3: File Export Dialog

File

Enter the file name or use the Browse button to select the file name for export.

Note Be sure to include the proper extension on the file name. The extensions (`.tif`, `.jpg`, `.gif`, etc.) are not automatically included in the file name.

Image Dimensions

Enter the X and Y dimensions of the export image. Use the droplist to select either pixels, inches, or centimeters.

Resolution

Enter the resolution of the image.

Note This option is not available if the image dimensions are in pixels.

Type Droplist

Select the export file type from this droplist. File types supported include:

BMP - Windows Bitmap

DAT - Structured Binary

GIF - Graphics Interchange Format

HDF - Hierarchical Data Format

JPEG, JPG - Joint Photographic Experts Group

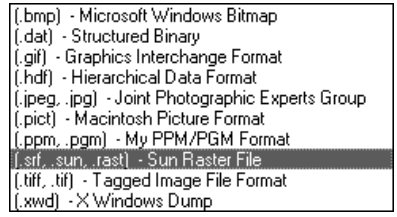
PICT - Macintosh Picture Format

PPM, PGM - PPM or PGM Format

SRF, SUN, RAST - Sun Raster File

TIFF, TIF - Tagged Image File Format

XWD - X Windows Dump


(.bmp) - Microsoft Windows Bitmap
(.dat) - Structured Binary
(.gif) - Graphics Interchange Format
(.hdf) - Hierarchical Data Format
(.jpeg, .jpg) - Joint Photographic Experts Group
(.pict) - Macintosh Picture Format
(.ppm, .pgm) - My PPM/PGM Format
(.srf, .sun, .rast) - Sun Raster File
(.tiff, .tif) - Tagged Image File Format
(.xwd) - X Windows Dump

VRML - Virtual Reality Modeling Language (Note: This format is not available when exporting with the Data Manager. It is only available when exporting using Insight's main "Export Menu Option" on page 20.)

NOTE: The following options apply only to the JPEG (or JPG)

Order Droplist

Select the order in which the export file will be written: "Top to Bottom" or "Bottom to Top".

Progressive Scans Droplist

Select "Yes" to write the image as a series of scans of increasing quality, or "No" to write the image all at once.

Quality

Enter the quality of the export file. The quality scale ranges from 0 (bad) to 100 (excellent). The default is 75 which is considered very good quality.

Note You can export a file with a file format other than standard IDL formats by writing a File PlugIn that handles the desired file format. See "File PlugIns" on page 206. Once you have added a File PlugIn to Insight, it will be contained in the list of available file formats.

For more information about exporting files, see WRITE_JPEG and other WRITE_(TYPE) functions in the *IDL Reference Guide.*

Import File Menu Option

Select “Import File” to import an data file (TIFF, JPEG, etc.). A file selection dialog opens; select the file you wish to import and click “OK”. If Insight recognizes the file extension (`.gif`, `.jpg`, etc.), it will automatically import the file. If it does not recognize the file extension (or if there is more than one method for opening files of the specified type), it will open the Select File Format for Import dialog, allowing you to choose a file format.

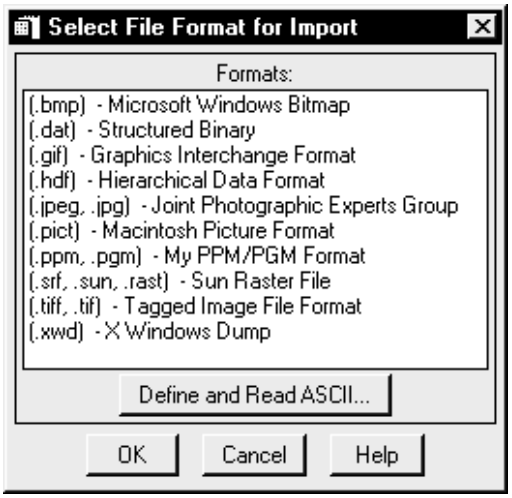

Select File Format for Import
Formats:
(.bmp) - Microsoft Windows Bitmap
(.dat) - Structured Binary
(.gif) - Graphics Interchange Format
(.hdf) - Hierarchical Data Format
(.jpeg, .jpg) - Joint Photographic Experts Group
(.pict) - Macintosh Picture Format
(.ppm, .pgm) - My PPM/PGM Format
(.srf, .sun, .rast) - Sun Raster File
(.tiff, .tif) - Tagged Image File Format
(.xwd) - X Windows Dump
Define and Read ASCII...
OK
Cancel
Help

Figure 3-4: Select File Format for Import Dial

The various file types should be familiar to most users with the possible exception of the `.hdf` format, which stands for “Hierarchical Data Format” or HDF. For more information about HDF, see the *Scientific Data Formats* manual.

If you select “Define and Read ASCII...” from the Select File Format for Import dialog, Insight will allow you to interactively define the format of an ASCII data file and then read the file. The ASCII file reader is described in “Reading ASCII Format Files” on page 37.

Note You can import a file with a file format other than standard IDL formats by writing a File PlugIn that handles the desired file format. See “File PlugIns” on page 206. Once you have added a File PlugIn to Insight, it will be contained in the list of available file formats.

When you import data, Insight places the data in the project’s data area. You can view the name and other attributes of the data in the Data Manager window.

Import File As Menu Option

Select “Import File As...” to import a data file. The only difference between this option and “Import File” is that choosing “Import File As...” will always prompt you with the

Select File Format for Import dialog, even when the file extension matches one of the extensions that Insight knows about.

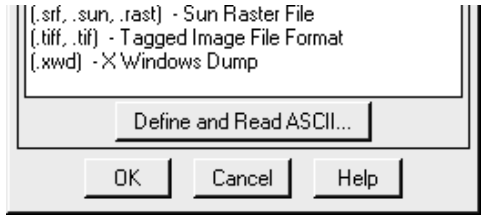
Import IDL Variables Menu Option

Select “Import IDL Variables...” to open the Import IDL Variables dialog, which allows you to import one or more IDL variables from the IDL MAIN level into the project.

Close Menu Option

Select this option to close the Data Manager window.

Reading ASCII Format Files



Selecting the "Define and Read ASCII..." option in the Select File Format for Import dialog launches an interface which allows you to define the format of your ASCII file. It then reads your data into Insight. (See ASCII_TEMPLATE and READ_ASCII in the *IDL Reference Guide*.)

After the data is successfully read, a native file browser will let you save the ASCII file description, or "template", as a File PlugIn. If you have multiple files of the same format, this will enable you to read them into Insight without having to redefine the format each time.

The PlugIn should be put into a directory of your PlugIns Path, and be saved with a .pro extension. Since the PlugIn is IDL code, you may customize it, if desired (see “File PlugIns” on page 206 for further information).

If you do not want a File PlugIn created, simply cancel from the file browser.

See “Importing ASCII Data” on page 184 for a tutorial on using Insight’s ASCII reading capabilities.

Editing and Creating Data

The Data Manager’s Edit menu provides options for working with data, including viewing and modifying data attributes, viewing data values, and creating new data.

Undo Menu Option

Select “Undo” to reverse the most recent action taken. You can “undo” the following actions: delete, duplicate, create scalar, create array, attribute changes, and data conditioning operations. In general, you have the option to undo an action until you take the next action.

Redo Menu Option

Select this option to reverse the previous “Undo” action. You can select this option after selecting the Undo option.

Delete Menu Option

Select this option to remove the selected data from the project.

Duplicate Menu Option

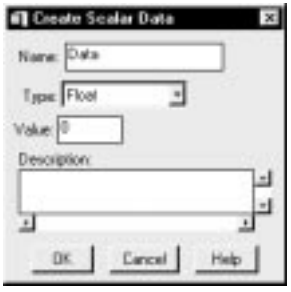
Select this option to duplicate selected data. The duplicate data appears in the Data Manager window with a name generated by Insight and based on the original name.

Create Data Menu Option

Select this option to access a submenu of data types you can create: “Scalar...” or “Array...”. In IDL, data can be scalars or arrays of up to eight dimensions. For more detail on data types, see “Type” on page 32.

Scalar

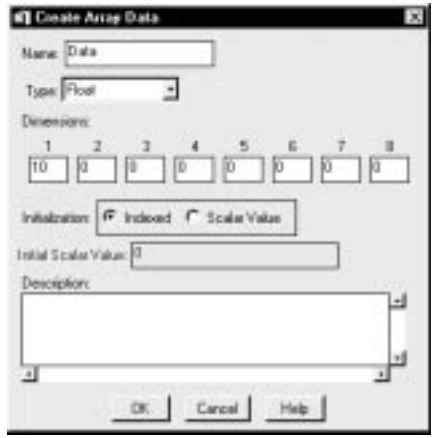
Select this option from the Create Data menu to create a single-element variable (a scalar). The Create Scalar Data dialog appears.



1. To change the name, click in the “Name” text field and edit.
2. From the “Type” droplist, select a type of scalar: Byte, Integer, Long Integer, Float, Double Float, Complex, Double Complex, and String.
3. Enter a value in the “Value” text field.
4. Enter a description of the scalar in the “Description” text field, if you wish.
5. When you are finished, click “OK”. Insight stores the scalar and lists its attributes in the Data Manager window.

Array

Select this option from the Create Data menu to create data with up to eight dimensions.The Create Array Data dialog appears.



1. To change the name, click in the "Name" text field and edit.
2. From the "Type" droplist, select a type of array: Byte, Integer, Long Integer, Float, Double Float, Complex, Double Complex, and String.
3. Enter values in the "Dimensions" text fields that correspond to the size of each array dimension.
4. Select "Scalar Value" or "Indexed" initialization type. If you select "Indexed", the array will be set to zero for the first element and incremental values for the rest of the array. If you select "Scalar Value", each element of the array will be initialized with the value you enter in the "Initial Value" text field.
5. If you selected "Scalar Value" type, enter a number (or value) in the "Initial Value" text field.
6. Enter a description in the "Description" text field, if you wish.
7. When you are finished, click "OK". Insight stores the array in the project.

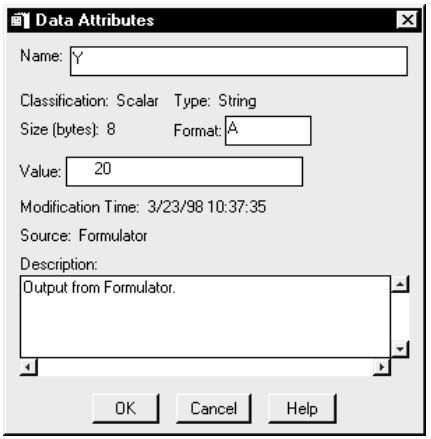
   To view the data, see the Data Manager window.

Attributes Menu Option

Select this option to open the Data Attributes dialog, which allows you to view and edit attributes of data selected in the Data Manager window.

The Scalar Data Attributes dialog

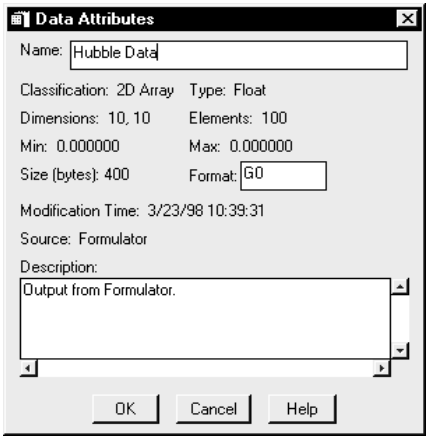
Attributes listed in the Scalar Attributes dialog include name, classification, type, dimensions, elements, size, value, minimum, maximum, source, description, and last modification date and time.



1. To change the name, click in the "Name" text field and edit.
2. To modify the value, click in the "Value" text field and edit.
3. To add or change a description, click in the "Description" text field and add or edit.
4. Use the "Format" field to enter a format string (minus parenthesis) which will be used as the default format for displaying data values textually. See format codes in *Using IDL* for more information.
5. When you are finished, click "OK" to change the attributes for the data and close the dialog.

The Array Data Attributes dialog

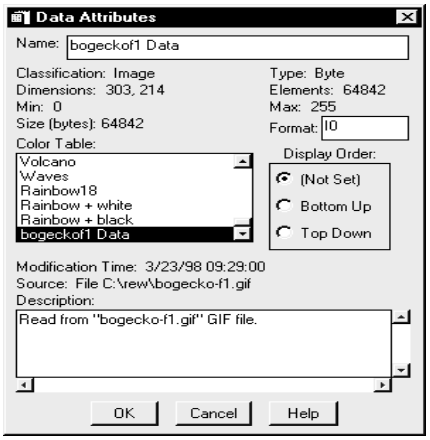
Attributes listed in the Array Attributes dialog include name, classification, type, dimensions, elements, size, minimum, maximum, source, description, and last modification date and time.



1. To change the name, click in the "Name" text field and edit.
2. To view the value of an Array, see "Value Menu Option" on page 42.
3. To add or change a description, click in the "Description" text field and add or edit.
4. Use the "Format" field to enter a format string (minus parenthesis) which will be used as the default format for displaying data values textually. See format codes in *Using IDL* for more information.
5. When you are finished, click "OK" to change the attributes for the data and close the dialog.

The Image Data Attributes dialog

Attributes listed in the Image Attributes dialog include name, classification, type, dimensions, elements, size, minimum, maximum, source, display order, true color, color table, description, and last modification date and time.



1. To change the name, click in the "Name" text field and edit.
2. Select "Bottom Up", "Top Down", or "Not Set" to specify the order in which the image should be written to the screen. If you select "Not Set", Insight determines the order based on the image's visualization properties.
3. From the scrolling list, select the color table desired. Only indexed color images use color tables. For more information, see "Color Tables" in Chapter 12 of *Using IDL*.
4. Use the "Format" field to enter a format string (minus parenthesis) which will be used as the default format for displaying data values textually. See format codes in *Using IDL* for more information.
5. To modify a description, click in the "Description" text field and edit.
6. When you are finished, click "OK". Data attributes are changed and the dialog closes.

Statistics Menu Option

Select "Statistics..." to open a *Statistics* dialog which displays the following information about the selected data:

Minimum: the minimum value.

Maximum: the maximum value.

Mean: the average value of a set of values.

Mean Absolute Deviation: the sum of the absolute distance of each sample element from the population (or set of values) mean.

Median: the value in an ordered set of values below and above which there is an equal number of values or which is the arithmetic mean of the two middle values if there is no one middle number.

Variance: the square of the standard deviation.

Standard Deviation: the root mean square of the deviations (distances) from the population mean.

Skewness: lack of symmetry.

Kurtosis: The peakedness or flatness of the graph of a frequency distribution, especially with respect to the concentration of values near the mean as compared with the normal distribution.

Value Menu Option

The Scalar Value Dialog

If you have selected scalar data, the Scalar Value dialog opens. When you are finished, click “Close”.

The Array Value Dialog

If you have selected array data, the Array Value dialog opens. Use the scroll bars to navigate to all rows and columns in the “Dimensions” table. Choose up to two dimensions (if applicable) to display. For example, if you select “16” in the Dim 1 column and “*” in Dim 2 column, the table will display the values for all the rows of column 16.

Viewing Data

The Data Manager’s View menu provides options for displaying data and attributes in the Data Manager window.

All Attributes Menu Option

Select “All Attributes” to view all attributes for all data in the Data Manager window.

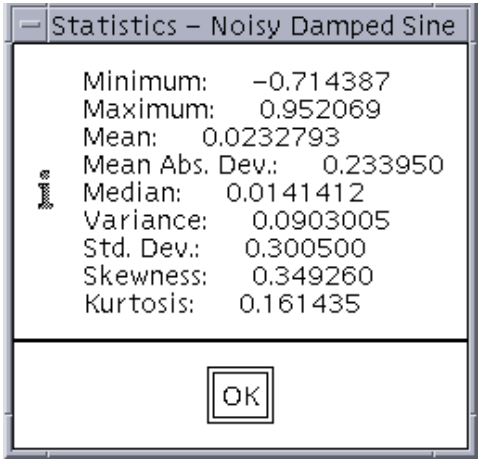


Figure 3-5: Statistics Dialog with example statistics for Noisy Damped Sine data

Partial Attributes Menu Option

Select “Partial Attributes...” to open the Partial Attributes dialog in which you can specify attributes you wish to view for data in the Data Manager window. Select the checkbox to the left of each desired attribute. When you have finished, click “OK”. Insight displays the selected attributes and hides the rest from view.

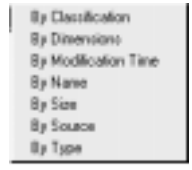
Figure 3-6: Partial Attributes Dialog

Filter Menu Option

Select “Filter” to view a submenu of options representing data classifications. When you select one of the options, Insight displays only data matching that classification in the Data Manager window. For example, if you select the “Image” menu option, Insight only displays the names and attributes of data classified as images. See “Data Attributes” on page 31.

Sort Menu Option

Select “Sort” to view a submenu of options representing the data attributes by which you can sort. Sort options include: classification, dimensions, modification time, name, size, source, and type. When you select an option, Insight sorts all data in the Data Manager window by that attribute. For example, if you select the “By Type” menu option, Insight sorts and displays data by type. All “Byte” data would be listed together followed by all data items for another type.



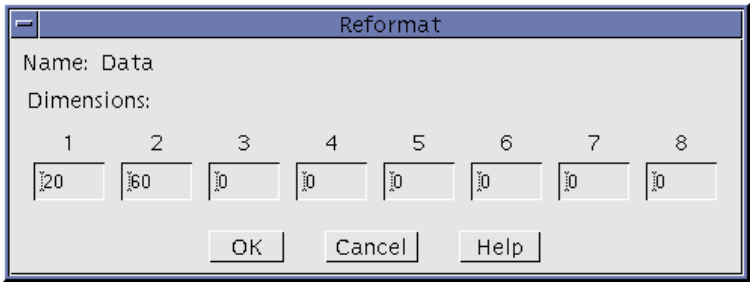


Figure 3-7: Reformat Dialog for Vectors and Arrays (up to 8

Note You also can sort by simply clicking the desired column header in the Data Manager window.

Conditioning Data

Use the Data Manager's Condition menu options to reformat, resize, reverse, sample, sort, and transpose data.

Note The difference between data conditioning and data analysis: Data conditioning involves relatively simple operations which modify the values of existing data items. Data analysis is typically a more complicated process whereby multiple data items may be used together in an algorithm to generate, replace, or modify data items, optionally applying different parameters on a trial basis, and visualizing the result.

Reformat Menu Option

Select "Reformat" to open the Reformat dialog in which you can view or modify the dimensions of a selected array without changing the total number of elements. Reformat dialog options depend on dimensionality of the selected data. The array can have one to eight dimensions. Only the dimensions of the array are changed; the actual data remains unmodified. For more details, see "REFORM" in the *IDL Reference Guide*.

Using The Reformat Dialog

1. Select data in the Data Manager window.
2. Select the "Reformat" option from the Condition menu. The Reformat dialog opens. The dialog displays the name of the data and the size of each dimension.
3. Edit the "Dimension" text fields with the desired sizes.
4. When you are finished, click "OK".

Resize Menu Option

Select “Resize” to open the Resize dialog which allows you to shrink or expand the size of an array by an arbitrary amount. Insight computes intermediate data values based on the existing data values. Resize dialog options depend on dimensionality of the selected data. The array can have one to three dimensions. For one- and two-dimensional arrays, Insight uses one of three methods: nearest neighbor sampling, linear interpolation, or convolution interpolation. For three-dimensional arrays, Insight uses linear interpolation. For more details, see “CONGRID” in the *IDL Reference Guide*.

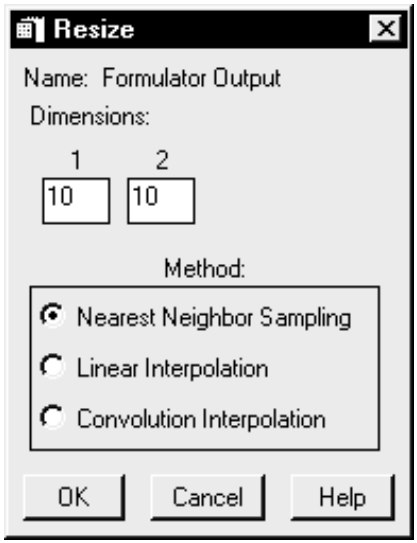


Figure 3-8: Resize Dialog for 2D Arrays

Using The Resize Dialog

1. Select data in the Data Manager window.
2. Select the “Resize” option from the Condition menu. The Resize dialog opens. The dialog displays the name of the data and the size of each dimension.
3. Edit the “Dimensions” text fields with the desired sizes.
4. For one- and two dimensional data: From the “Method” panel select “Nearest Neighbor Sampling”, “Linear Interpolation”, or “Convolution Interpolation”. Insight uses Linear Interpolation for three-dimensional data.

- *Nearest Neighbor Sampling* computes an intermediate data value, called an “interpolate,” by averaging the points immediately surrounding the location of the interpolate in all possible directions.
- *Linear Interpolation* computes an intermediate data value using the points immediately surrounding the location of the interpolate in only one direction.

- *Convolution Interpolation* uses the “Cubic Convolution” algorithm.

5. When you are finished, click “OK”. You can view the data’s new dimensions in the “Dimensions”” column in the Data Manager window or in the Attributes dialog

Reverse Menu Option

Select “Reverse” to open the Reverse dialog in which you can reverse the order of entries in a one to three-dimensional array. Reverse dialog options depend on dimensionality of the selected data. For more details, see “REVERSE” in the *IDL Reference Guide*.

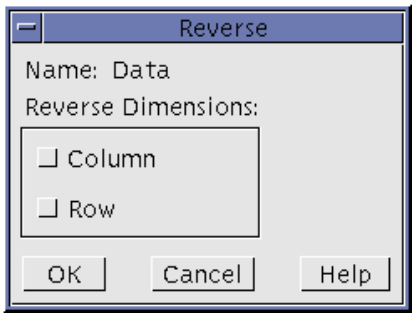


Figure 3-9: Reverse Dialog for 2D Arrays

Using The Reverse Dialog

In the dialogs for two- and three-dimensional arrays, select the dimensions to reverse. Click “OK”.

Sample Menu Option

Select “Sample” to open the Sample dialog in which you can create a subset of a selected array. Sample dialog options depend on dimensionality of the selected array. The array can have one to eight dimensions. This allows you to zero in on specific features of your data. For example, for a 10 X 10 X 10 array, you can see elements 2 through 4 in the first dimension, 5 through 7 in the second dimension, and 1 through 8 in the third dimension. Simply edit the “From” and “To” text fields with the desired values. Note that dimension values must be greater than or equal to zero and less than the size of the dimension minus one.

Sort Menu Option

Select “Sort” to open a Sort dialog in which you can sort selected vectors in ascending or descending order. For more detail, see “SORT”, “ROTATE”, and “UNIQ” in the *IDL Reference Guide*.

Using The Sort Dialog

1. Select to sort the data values in either “Ascending” or “Descending” order.

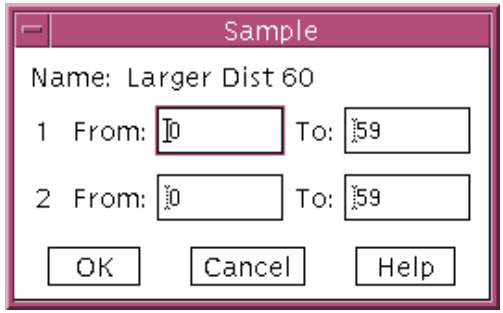


Figure 3-10: Sample Dialog for 2D Arrays

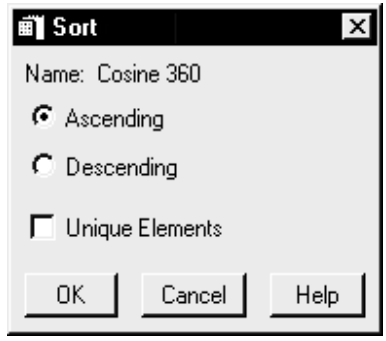


Figure 3-11: Sort Dialog for Vectors

2. Select the “Unique Elements” checkbox to keep repeated values out of the sort. Insight will then sort only unique values.

Transpose Menu Option

Select “Transpose” to open a Transpose dialog which allows you to transpose an array. The array can be one to eight dimensions. Transpose dialog options depend on dimensionality of the selected data. For a two-dimensional array, Insight rearranges the dimensions of the array from column major format to row major format or vice versa. Row major format means that the linear order of the data elements proceeds from the first element of the first row through the last element of the first row before beginning on the second row, etc. For arrays of higher dimensionality, the Transpose dialog allows you to specify the transposition order. For more detail, see “TRANSPOSE” in the *IDL Reference Guide*.

Hint This is especially helpful if you wish to use an array in the Data Manager as input to an IDL function that expects data in row-major format. IDL always allocates and references data in row-major format.

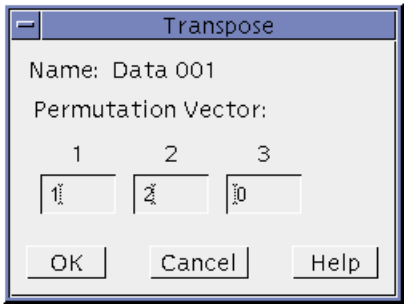


Figure 3-12: Transpose Dialog for 3D Arrays

If the data has three-to eight dimensions, you can enter a permutation vector. For one - dimensional data, the Transpose option converts between a row and column vector. For two-dimensional data, the rows and columns are switched, but no permutation vector is required.

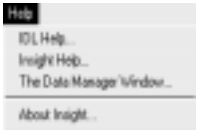
PlugIns Menu Option

Select “Plugins” to view a submenu of Conditioning PlugIns. Selecting one of the PlugIns displayed performs the PlugIn’s conditioning operation on the item selected in the Data Manager window.

A PlugIn is a routine written in the IDL language. PlugIns must follow Insight’s PlugIn conventions as described in “Extending Insight” on page 203. Conditioning PlugIns modify the value of a selected Insight data item. You can add Conditioning PlugIns to perform such tasks as rotating, scaling, rounding, and shifting.

Help Menu

The Data Manager Help menu provides options for getting help. Using these options, you can access online help files and get information on IDL and Insight. To find out how to use these options, see “Getting Help” on page 27.



Chapter 4

Visualizing Data

The following topics are covered in this chapter:

What Is Visualization? 50
The Visualization Window 50
The Visualize Menu 52
Line Plots 53
Scatter Plots 54
Histogram Plots 55
Polar Plots 56
Contours 58
Images 59
Surfaces 60
The View Menu 63
Selecting Visualizations 66

This chapter describes visualization. It introduces the Insight Visualization window and its menubar and toolbar. You will learn how to use the Visualize menu to display data and the View menu to customize your view of data in the window.

What Is Visualization?

We use the term *visualization* as a catch-all to refer to a data set that has been displayed on your computer in some format. Visualizations include plots, contours, surfaces, images, and all of the ancillary elements that go along with them — axes, annotations, etc. When you display data in Insight, you see it appear in the *Visualization window*.

Using the window's Visualize menu options, you can display several types of visualizations: line plots, scatter plots, histogram plots, polar plots, contours, surfaces, and images. The graphic parts that make up a visualization — the plot or image, axes, tickmarks, annotations, etc. — are called elements in this document. Often, each element of a visualization has its own set of properties (location, color, width, style, etc.) and can be customized independently of the other elements in the visualization. You can view and modify properties using the element's Properties dialog. See "The Properties Dialogs" on page 74 for details on setting properties.

The Visualization Window

When you start Insight and open a new or existing Insight project, the Visualization window appears on your screen as a viewing area with a menubar and toolbar. The Visualization Window is shown in Figure 4-1.

The Visualization window is the primary workspace in which you visualize data. It is also the hub from which you can navigate to:

- Analysis dialogs which allow you to analyze, generate, and modify data and visualizations,
- the Data Manager window, where Insight lists names and attributes of all existing project data.
- other Insight projects

By default, the existing visualization is cleared from the Visualization window when a new visualization is created. See "Retain All Visualizations" on page 65 for details on how to alter this behavior.

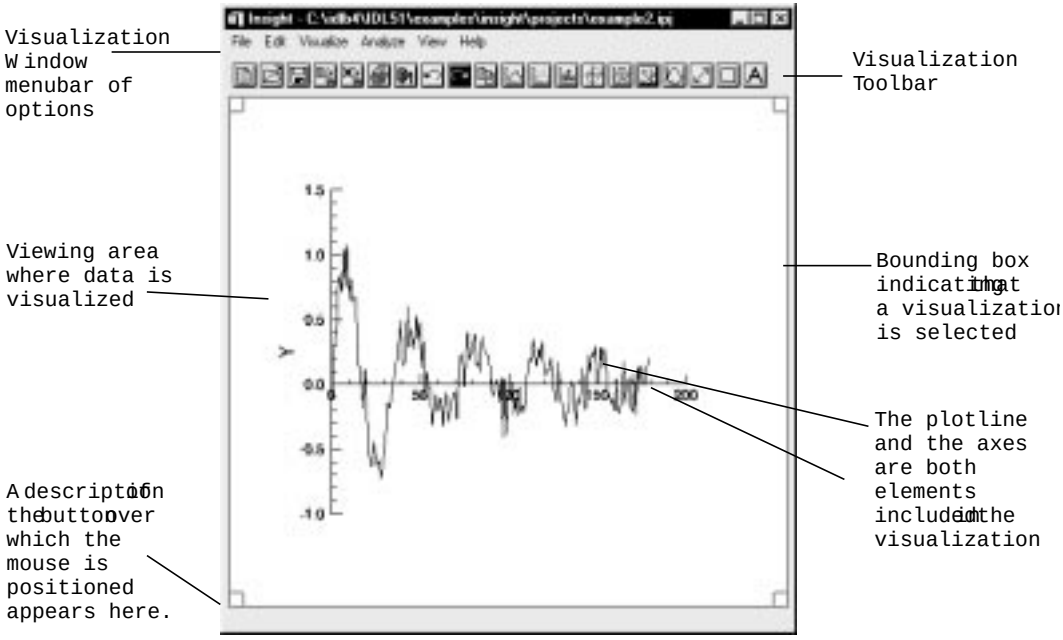

Visualization Window menubar of options
Viewing area where data is visualized
A description of the button over which the mouse is positioned appears here.
Visualization Toolbar
Bounding box indicating that a visualization is selected
The plotline and the axes are both elements included in the visualization

Figure 4-1: Visualization Window (shown with an example)

Insight Toolbar

The Insight Toolbar appears across the top of the Visualization window below the menubar. The Toolbar features buttons corresponding to various menu options. When a menu option is disabled, the corresponding toolbar button is disabled as well. When you move the mouse over each button, the name of the button appears in the lower left-hand corner of the Visualization window. The figure below shows the default toolbar buttons.

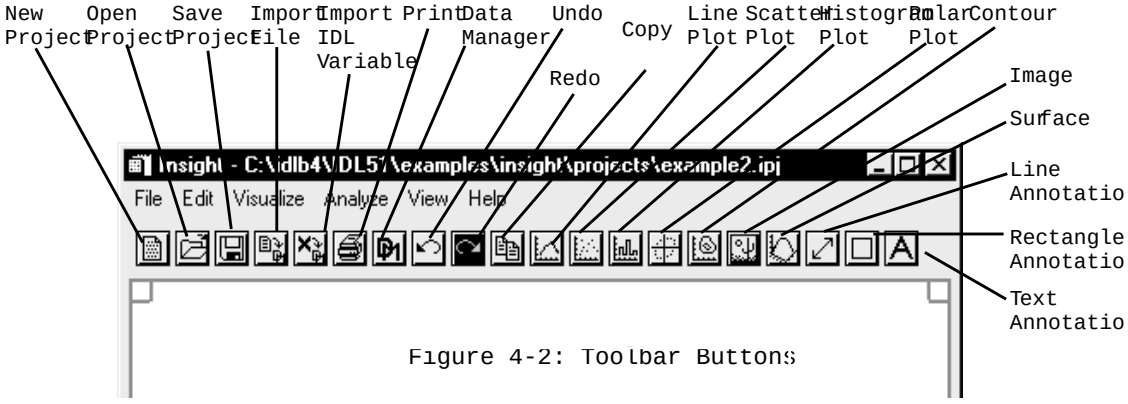


Figure 4-2: Toolbar Buttons

Visualization Window Menubar

The menubar across the top of the Visualization window groups Insight operations into six main menus: File, Edit, Visualize, Analyze, View, and Help. When you select a menu option that is followed by an ellipsis (...), Insight opens a dialog or window so you can enter more information or select options before performing an operation.

You'll find descriptions of Visualization window menus throughout this volume. Chapter 2, "Getting Started" describes the File menu (project management options) and Help menu options. Chapter 5, "Working With Visualizations", describes the Edit menu (how to edit, annotate, and change the properties of visualizations). Chapter 6, "Analyzing Data", describes the Analyze menu (performing analyze operations, accessing Analysis PlugIns, using the formulator). This chapter describes the Visualize Menu (how to display data in the Visualization window) and View Menu (how to specify your view in of the data in the window).

The Visualize Menu

The Visualize menu provides options for visualizing data in the Visualization window. Using these options you can visualize line plots, scatter plots, histogram plots, polar plots, contours, images, and surfaces. Each option opens a dialog from which you can select data and specify options. The data items available include data in the project that fit the current operation. For example, data of type "Image" are not available when creating a line plot.

Note You can also access the visualize menu options (line plot, scatter plot, histogram plot, polar plot, contour, image, and surface) from the toolbar.

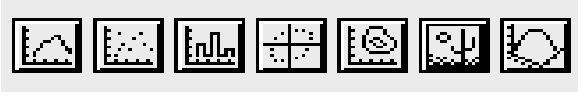


Figure 4-3: Toolbar Selections (line plot, scatter pl
histogram plot, polar plot, contour, image, and surfac

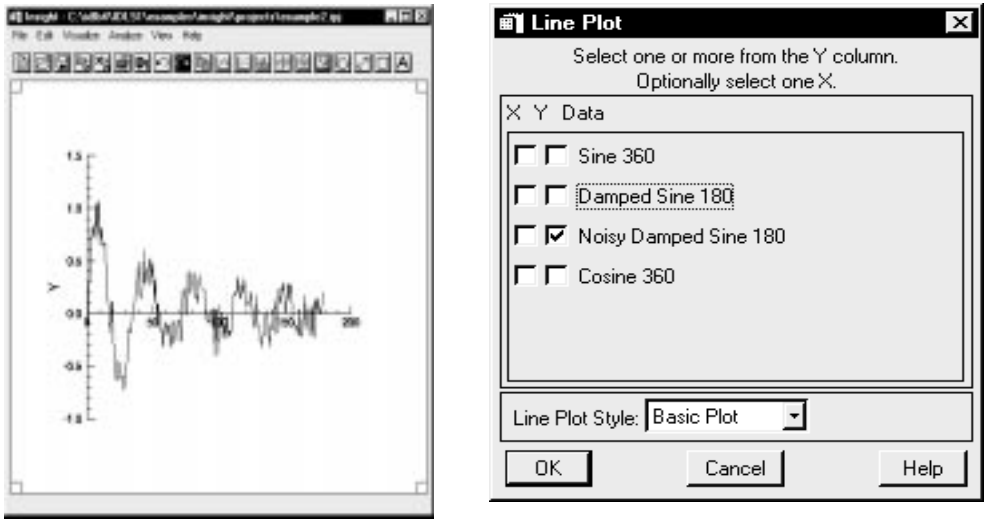


Figure 4-4: Line Plot and Line Plot Dialog

Line Plots

Select “Line Plot” to open a Line Plot dialog from which you can select data and options for drawing a line plot in the Visualization window. A line plot is a plot of data points with straight line segments connecting them.

The Line Plot Dialog

Selecting the “Line Plot” option from the Visualize menu opens the Line Plot dialog.

1. Select one or more vectors by checking the box in the “Y” column to the left of one or more data items in the data selection list.

   If you select only the “Y” column for a data item, Insight will label the Visualization’s Y axis with data values (the dependent data) and label the X axis with the indices of the data item.

   Optionally, select one box in the “X” column for any data item in the list. If you select an X and a Y, Insight will plot the Y (the dependent data) as a function of the X (independent data).

2. From the “Plot Style” droplist, select a style. Styles determine the “look” of your visualization. For more information on styles, see “About Styles” on page 100.

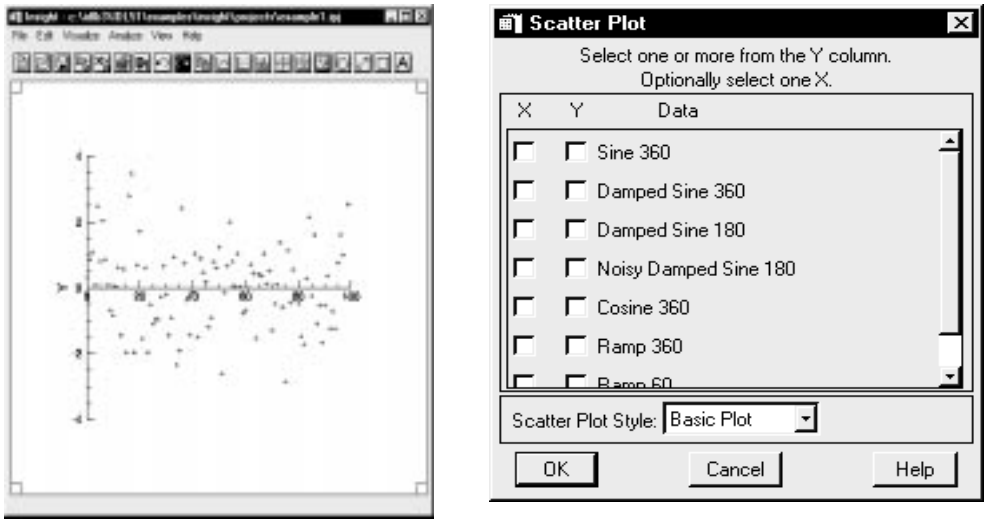


Figure 4-5: Scatter Plot and Scatter Plot Dialog

Note If you want to view more than one visualization at a time, set up the *tiling scheme* in your Visualization window. Always set up the tiling scheme *before* doing a visualization. For more details, see "The View Menu" on page 63.

3. When you are finished with the dialog, click "OK". The dialog closes and Insight displays the plot in the Visualization window. To view or modify this plot, see "Editing Visualizations: The Edit Menu" on page 68 or "Properties (Visualizations)" on page 73.

Scatter Plots

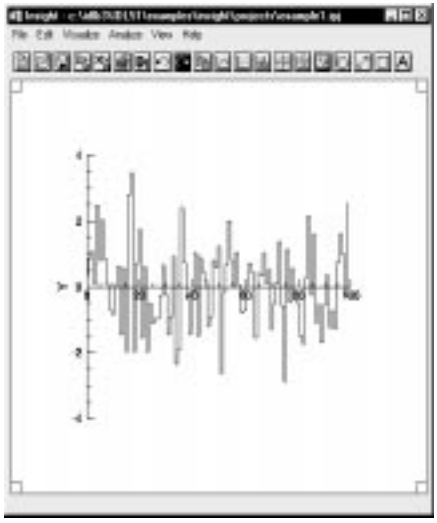
Select "Scatter Plot" to open a Scatter Plot dialog from which you can select data and options for drawing a scatter plot in the Visualization window. A scatter plot contains plotted symbols at data points without connecting them.

The Scatter Plot Dialog

Selecting the "Scatter Plot" option from the Visualize menu opens the Scatter Plot dialog.

1. Select one or more vectors by selecting the "Y " box to the left of one or more data items in the data selection list.

   If you select only the "Y" box for a data item, Insight will label the Visualization's Y axis with data values (the dependent data) and label the X axis with the indices of the data item.



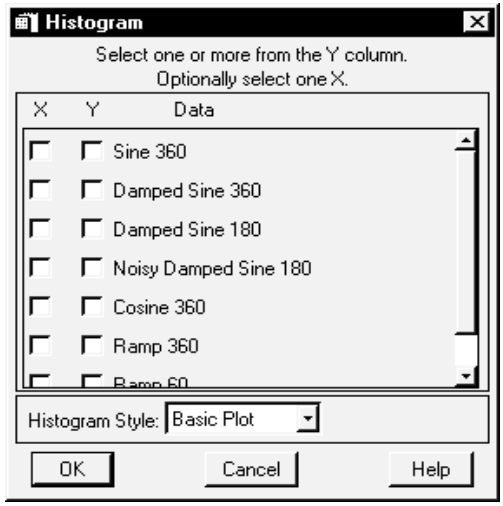


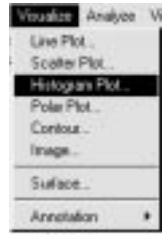
Figure 4-6: Histogram Plot and Histogram Dialog

Optionally, select one “X” box for any data item in the list. If you select an X and a Y, Insight will plot the Y (the dependent data) as a function of the X (independent data).

2. From the “Scatter Plot Style” droplist, select a style. Styles determine the “look” of your visualization. For more information on styles, see “About Styles” on page 100.

3. When you are finished with the dialog, click “OK”. The dialog closes and Insight displays the plot in the Visualization window. To view or modify this plot, see “Editing Visualizations: The Edit Menu” on page 68 or “Properties (Visualizations)” on page 73.

Histogram Plots



Select this option to open a Histogram Plot dialog from which you can select data and options for drawing a histogram plot in the Visualization window. A histogram plot shows horizontal and vertical lines connecting data points.

The Histogram Dialog

Selecting the “Histogram” option from the Visualize menu opens the Histogram dialog.

1. Select one or more vectors by selecting the “Y ” box to the left of one or more data items in the data selection list.

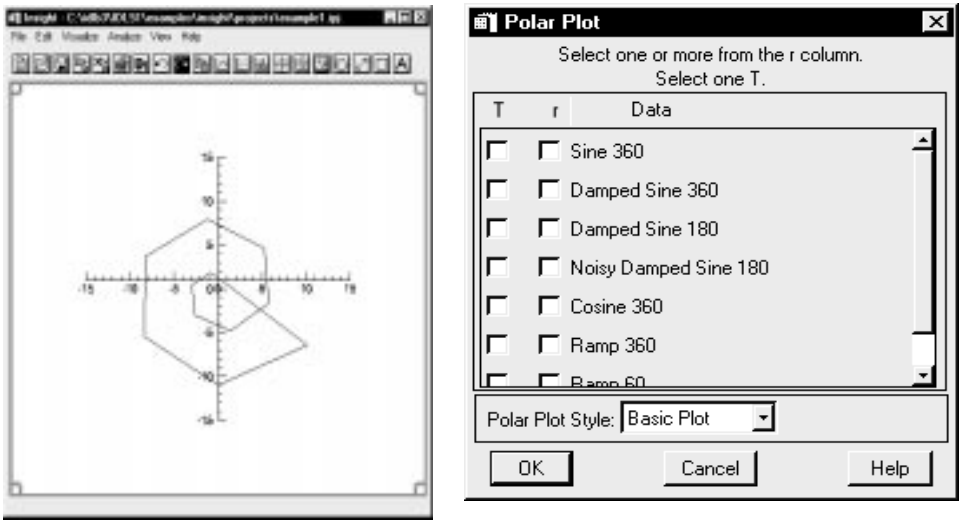


Figure 4-7: Polar Plot and Polar Plot Dialog

If you select only the “Y” box for a data item, Insight will label the Visualization’s Y axis with data values (the dependent data) and label the X axis with the indices of the data item.

Optionally, select one “X” box for any data item in the list. If you select an X and a Y, Insight will plot the Y (the dependent data) as a function of the X (independent data).

2. From the “Histogram Style” droplist, select a style. Styles determine the “look” of your visualization. For more information on styles, see “About Styles” on page 100.

3. When you are finished with the dialog, click “OK”. The dialog closes and Insight displays the plot in the Visualization window. To view or modify this plot, see “Editing Visualizations: The Edit Menu” on page 68 or “Properties (Visualizations)” on page 73.

Polar Plots

Select “Polar Plot” to open a Polar Plot dialog from which you can select data and options for drawing a polar plot in the window. A polar plot is a plot of data in the polar coordinate system (using angle Theta and radius instead of the cartesian (x, y) coordinate system). Polar plots display the data item in terms of angle (Theta: radians) and distance (r: radius) from the origin (0, 0).

The Polar Plot Dialog

Selecting the “Polar Plot” option from the Visualize menu opens the Polar Plot dialog.

1. Select one “T” (angle) box for any vector in the list.
2. Select one or more vectors in the “r” (radius) box in the data selection list.

Note You can only select one “T” (angle) box, but you can select multiple “r” (radius) boxes. The “r” vectors (dependent variables) are plotted against the “T” angle (independent variable).

3. From the “Polar Plot Style” droplist, select a style. Styles determine the “look” of your visualization. For more information on styles, see “About Styles” on page 100.
4. When you are finished with the dialog, click “OK”. The dialog closes and Insight displays the plot in the Visualization window. To view or modify this plot, see “Editing Visualizations: The Edit Menu” on page 68 or “Properties (Visualizations)” on page 73.

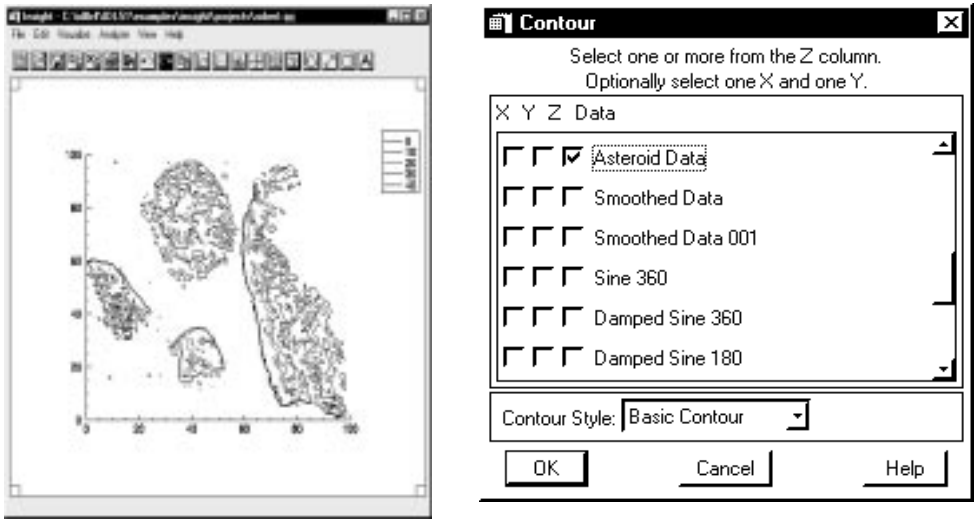


Figure 4-8: Contour and Contour Dialog

Contours

Select “Contour” to open a Contour dialog from which you can select a data item to display as a contour plot in the Visualization window.

The Contour Dialog

Selecting the “Contour” option from the Visualize menu opens the Contour dialog.

1. Select one data items by selecting the “Z” box to the left of one data item in the data selection list. Optionally select one “X” and one “Y” box for any data item in the list.
2. From the “Contour Style” droplist, select a style. Styles determine the “look” of your visualization. For more information on styles, see “About Styles” on page 100.
3. When you are finished, click “OK”. The dialog closes and Insight displays the contour in the Visualization window. To view or modify this surface, see “Editing Visualizations: The Edit Menu” on page 68 or “Properties (Visualizations)” on page 73.

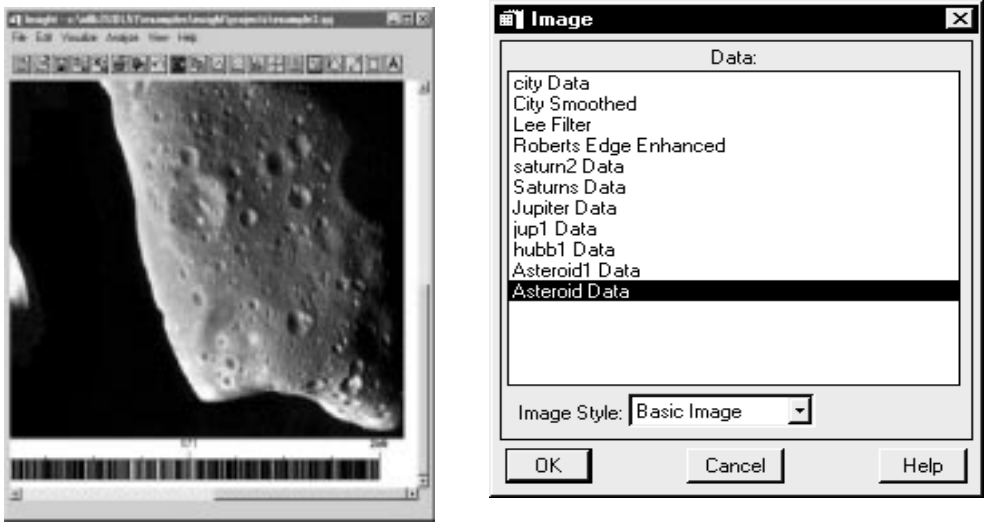


Figure 4-9: Image and Image Dialog

Images

Select “Images” to open an Image dialog from which you can select a data item to display as an image in the Visualization window. An image is often understood as a picture, but actually any two-dimensional data item can be displayed as an image. (Three-dimensional data items can be displayed as true-color images; one dimension each for the red, green, and blue values of the image.) An image is a two-dimensional array of pixels. The value of each pixel represents the intensity and/or color of that position in the visualization.

Note True color data must be of the form (3, x, y) for pixel interleave, (x, 3, y) for row interleave, or (x, y, 3) for planar interleave.

The Image Dialog

Selecting the “Image” option from the Visualize menu opens the Image dialog.

1. Select the name of an image in the data selection list.

Note The data items available include any data items in the Data Manager that fit the current operation. For example, data items of type “Image” are not available when creating a line plot.

2. From the “Image Style” droplist, select a style. Styles determine the “look” of your visualization. For more information on styles, see “About Styles” on page 100.

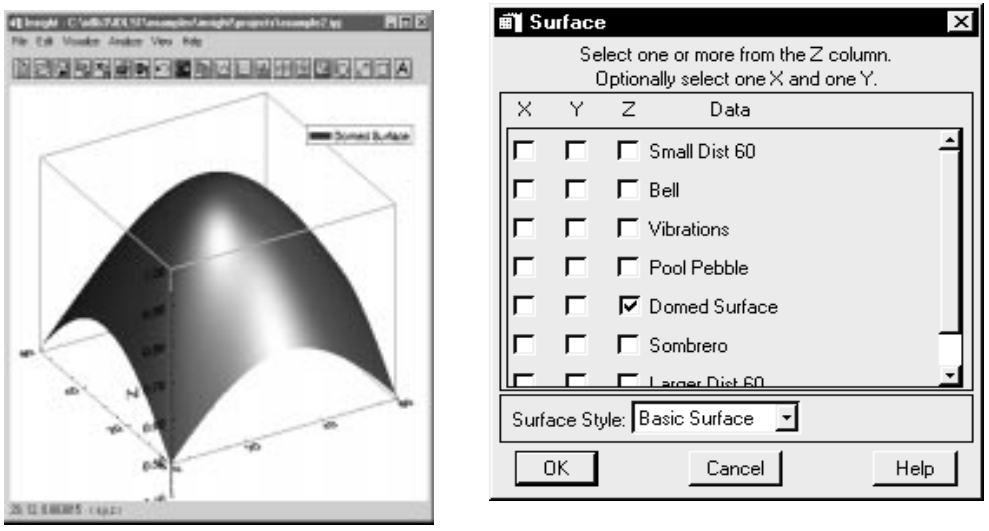


Figure 4-10: Surface and Surface Dialog

3. When you are finished, click “OK”. The dialog closes and Insight displays the image in the Visualization window. To view or modify this visualization, see “Editing Visualizations: The Edit Menu” on page 68 or “Properties (Visualizations)” on page 73.

Surfaces

Select “Surface” to open a Surface dialog from which you can specify data and options for displaying a three-dimensional surface in the Visualization window. Any two-dimensional data item can be displayed as a surface, or three-dimensional representation of the data item. Insight depicts the surface by interpreting each element value as an elevation.

The Surface Dialog

Selecting the “Surface” option from the Visualize menu opens the Surface dialog.

1. Select one data items by selecting the “Z” box to the left of one data item in the data selection list. Optionally, select one “X” and one “Y” box for any data item in the list.
2. From the “Surface Style” droplist, select a style. Styles determine the “look” of your visualization. For more information on styles, see “About Styles” on page 100.
3. When you are finished, click “OK”. The dialog closes and Insight displays the surface in the Visualization window. To view or modify this surface, see “Editing Visualizations: The Edit Menu” on page 68 or “Properties (Visualizations)” on page 73.

Annotations

Select “Annotation” to view a cascading menu of annotations available for your visualization. With this option, you can label and illustrate (annotate) visualizations displayed in the Visualization window. You also have the option of using the annotation

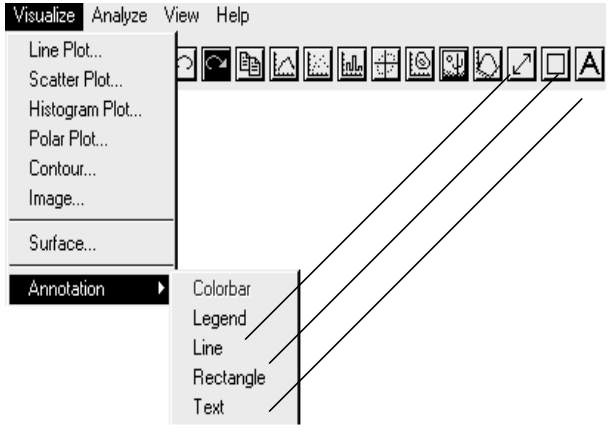


Figure 4-11: Selecting an Annotation from the Menu or from the toolbar.

buttons for “Line,” “Rectangle,” and “Text” which are located on the right-hand side of the toolbar; “Colorbar” and “Legend” do not have buttons.

Note An annotation must reside in a visualization and cannot span two or more visualizations in the Visualization window.

This section briefly describes how to use the different annotations. See Figure 4-12 below to see how the annotations appear on a visualization. For more detailed information, see “Properties Dialogs for Annotations” on page 90.

Colorbar Annotation

Select “Colorbar” to add a colorbar to your visualization. Colorbars will automatically be generated with indexed color images when an image visualization is created.

To set the colorbar properties, double-click the colorbar. The Colorbar Annotation Properties dialog opens (see “Colorbar Annotation” on page 90).

Note Colorbars are not available for true color images. The colorbar will correspond to the palette of the image; the axis will be index values into the palette. If the graphical properties of the image are changed, the colorbar will reflect that update (if necessary). The colorbar will always reflect the image in the visualization. If the associated image is deleted, the colorbar will not appear in the visualization.

Legend Annotation

Select “Legend” to add a legend to your visualization. Legends will be generated when a plot, contour or surface graph is created; legends are not generated for images.

To set the legend properties, double-click the legend. The Legend Properties dialog opens (see “Legend Annotation” on page 93).

Note The legend and colorbar menu options are not often necessary since they are automatically generated where available. They are useful for upgrading projects from previous versions of Insight, or when the legend or colorbar has been deleted.

Line Annotation

Select “Line” or click the “Line Annotation” button in the Visualization toolbar to add straight line segments to your selected visualization.

To set the line properties, double-click the line. The Line Annotation Properties dialog opens (see “Line Annotation” on page 96).

Rectangle Annotation

Select “Rectangle” or click the “Rectangle” annotation button in the Visualization toolbar to place a rectangle on your selected visualization.

To set rectangle properties, double-click the rectangle. The Rectangle Annotation Properties dialog opens (see “Rectangle Annotation” on page 97).

Text Annotation

Select “Text” or click the “Text” annotation button in the Visualization toolbar to place text on your selected visualization.

To set text properties, double-click the annotation text box. The Text Annotation Properties dialog opens (see “Text Annotation” on page 98).

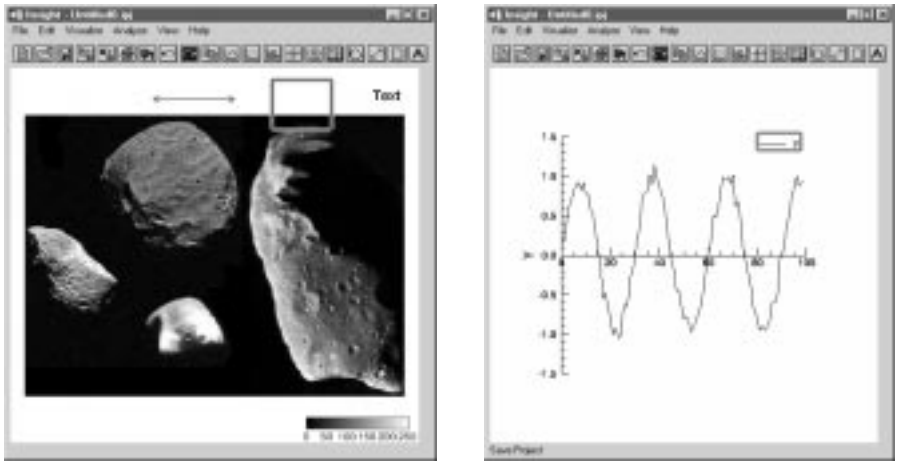
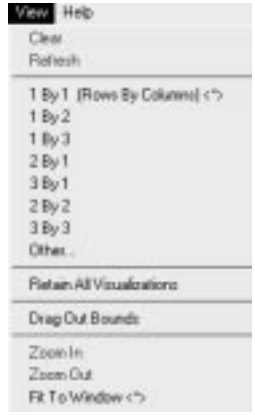


Figure 4-12 Annotations as they appear in a visualization before editing: Line, Rectangle, Text, and Colorbar (left); Legend (right).

The View Menu



The View menu provides options for customizing the way you view your visualizations. Using these options, you can clear the Visualization window, refresh the window, zoom, and specify how multiple visualizations should be displayed in the window.

Note These options are meant to be used *before* visualizations are created. They will not rearrange existing visualizations in the window.

The "Rows By Columns" options in this menu are helpful if you plan to visualize more than one visualization item simultaneously in the Visualization window. These options set up a "tiling scheme" containing a specific number of places for visualizations. The option you choose determines the number of "tiles" available in the window.

Note The tiling scheme does not affect existing visualizations. This means that if you have a single visualization filling the visualization window and then change the tiling scheme, the existing visualization will continue to fill the Visualization window.

For example, if you plan to view three visualizations simultaneously displayed in one row, select the “1 By 3” (Rows By Columns) option. Insight displays data items from left to right and from bottom row to top row, separating the tiles with a dotted line. If the tiling scheme is full and you continue to visualize data, Insight will replace visualizations starting in the first (bottom, left) tile. Figure 4-13 shows a 2 Row by 2 Column tiling scheme.

Note If you set “Retain All Visualizations” in the View menu, visualizations are not automatically replaced with the tiling scheme is full.

Clear

Select “Clear” to clear the Visualization window of all visualizations.

Refresh

Select “Refresh” to redraw the Visualization window viewing area.

1 By 1 (Rows By Columns) and Other Listed Schemes

Select one of the listed m By n tiling schemes to arrange tiles in the Visualization window. For example, selecting “1 By 1” sets up the Visualization window so it will contain one visualization. Similarly, the “1 By 2” option tiles the Visualization window such that it contains two visualizations, side by side, in a single row. The other listed tiling arrangements work the same way.

Visualizations are drawn into a tiled Visualization window starting with the bottom left tile, moving to the right and then up. The last visualization is displayed in the top right tile.

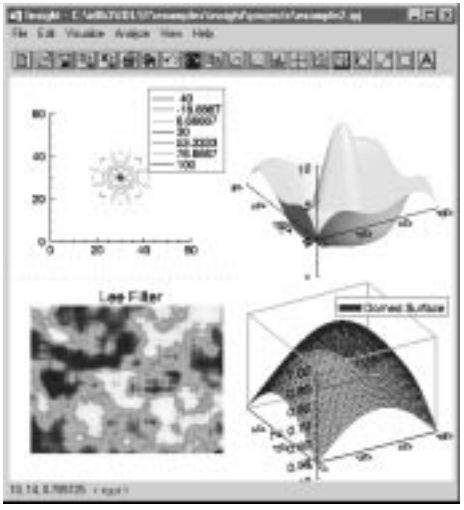


Figure 4-13: The Visualization window “tiled” to a 2 Row by 2 Column Grid

Other

Select “Other” to open an Other Configuration dialog which allows you to select the number of rows and columns in the Visualization window. Adjust the Rows slider to the desired number of rows (1-10). Adjust the Columns slider to the desired number of columns (1-10). When you are finished with the dialog, click “OK”. The dialog closes and the tile scheme specified appears as a “grid” in the Visualization window.

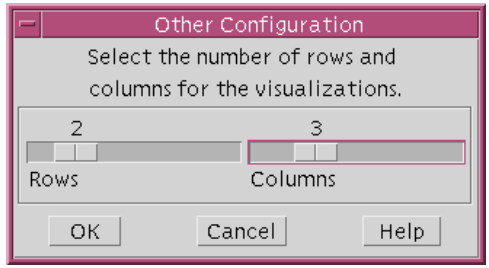


Figure 4-14: Tile Scheme Dialog

Retain All Visualizations

Select “Retain All Visualizations” to keep visualizations in Insight’s memory even when they have been covered up in the Visualization window by a new visualization. Retaining visualizations allows you to display one image on top of the other, or to switch back and forth between visualizations using the Visualization Manager (see “Visualization Manager” on page 68 for details.)

Note Retained visualizations consume memory. Deselect “Retain All Visualizations” if you find that Insight’s performance is degraded by holding numerous visualizations in memory.

Zoom In

Select “Zoom In” to magnify your view of the visualization(s) in the window by a factor of 2. Select this option until you reach the desired magnification. Each time you select this option, Insight magnifies the view of the visualization by a factor of 2. The maximum magnification is 1600 X 1200 pixels.

Zoom Out

Select “Zoom Out” to reduce the view of the visualization(s) in the window by a factor of 1/2. Select this option until you reach the desired reduction. Each time you select this option, Insight reduces the view of the visualization by 1/2.

Note Remember that when you use zoom options, you are not actually changing the size of the visualization – only your view of the visualization. If you select the print option while the visualization is zoomed, the printed visualization appears “unzoomed”.

Fit To Window

Select “Fit to Window” so that the contents of the Visualization window will automatically resize to fit the Visualization window. A symbol marks this menu option when it is turned “on.”

Selecting Visualizations

Insight allows you to interactively move and edit visualizations and visualization elements. Before you can move or edit an element, however, you must select it. Selected elements are highlighted (see “Preferences Dialog: General” on page 22 for information on changing the way selected elements are highlighted). You can select visualizations, elements, and annotations in the Visualization window in several ways:

- To select an entire visualization, click on the background of the visualization (not on an element). A bounding box will appear in the window indicating that the visualization has been selected. If the visualization is smaller than the Visualization window itself, you may be able to click outside the visualization; in this case, nothing will be selected.
- To select a single element or annotation, single-click on it. The element you clicked on will be highlighted. To select an element and open its properties dialog, double-click on the element.
- You also can select items in the window by selecting the “Visualization Manager” option from the Edit menu in the Visualization window. The Visualization Manager window opens with a list of the visualization and each of its elements, including ones that are “hidden” which might not be displayed in the window. Simply select the name of the desired visualization or element. Insight selects the item for you in the Visualization window. This option makes it easier to select when there are many elements in the Visualization window. Click “Edit” in the Visualization manager to open the selected element’s properties dialog. See “Visualization Manager” on page 68 for details.

Chapter 5

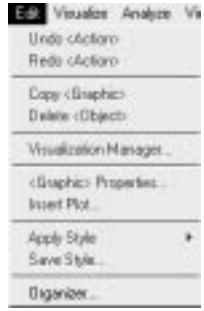
Working With Visualizations

The following topics are covered in this chapter:

Editing Visualizations: The Edit Menu 68
Sizing Visualizations 72
Moving Visualizations and Elements 72
Rotating Surfaces 72
Properties (Visualizations) 73
The Properties Dialogs 74
About Styles 100

This chapter explains how to work with Visualizations in the Visualization window. You will learn how to specify Visualization *properties*, move and size Visualizations, rotate surfaces, annotate Visualizations, and use the Edit menu for such tasks as opening the Visualization Manager window and applying and saving styles.

Editing Visualizations: The Edit Menu



The Edit menu provides options for changing the appearance of Visualizations, applying and saving styles, and opening the Visualization Manager window.

Undo

Select this option to reverse the previous action. You have the option to undo an action until your next action.

Redo

Select this option to reverse the previous "Undo" action. You can select this option after selecting the Undo option.

Copy

Select this option to copy a Visualization to the system clipboard. The Visualization will then be available (as a pasted bitmap) for other applications.

Delete

Select this option to remove a selected item (Visualization or element). Note that the axes cannot be deleted.

Visualization Manager

Select this option to open the Visualization Manager, which lists each Visualization element displayed in the window. Using the Visualization Manager, you easily can select and edit or delete elements or entire Visualizations.

Each Visualization name is followed by a list of its elements. Visualization names are listed in the order they are displayed in the window. When you select an item in the Visualization manager, it becomes the *top* item displayed; that is, it is drawn in the Visualization window last. (The order in which Visualizations are drawn becomes important when you place one Visualization over another.) If you select an item in the window, that item's name is highlighted when you open the Visualization Manager. When you select a name in the Visualization Manager, that item is selected in the Visualization window.

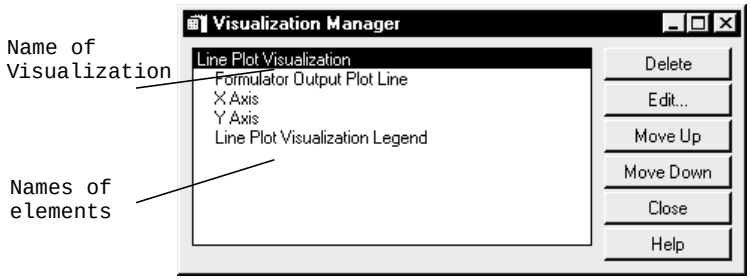


Figure 5-1: Visualization Manager Window

Using the Visualization Manager

1. In the list on the left-hand side of the window, click on the name of the element or Visualization you'd like to select, edit, or delete. Insight selects that item in the Visualization window.

Note The order of the list will change upon selection if the "Bring To Front" preference is set.

2. To delete the item, click "Delete". Insight deletes the item from the Visualization window. To edit the properties of the selected item, click "Edit". The Properties dialog opens, displaying properties for the selected item. Edit the properties as desired. (To find out how to modify Properties, see "The Properties Dialogs" on page 74.)

3. Use the "Move Up" or "Move Down" buttons to adjust the draw order in the window. The draw order is in ascending order from top to bottom.

   You may leave the Visualization Manager window open during your Insight session. Click "Close" to close the window.

<Graphic> Properties

Select this option to open a Properties dialog for the currently selected graphic. You can also open this dialog by double clicking on a Visualization or element. See "Properties (Visualizations)" on page 73. Note that the term inside the brackets (<Graphic>) will depend on what is selected in your Visualization.

Insert Plot

Select this option to open an "Insert Plot" dialog, which allows you to select one or more data items to insert into a line, scatter, histogram, or polar plot. Before selecting this

option you must first select the Visualization (or element of a Visualization) in the Visualization window into which you'd like to insert an additional plot element.

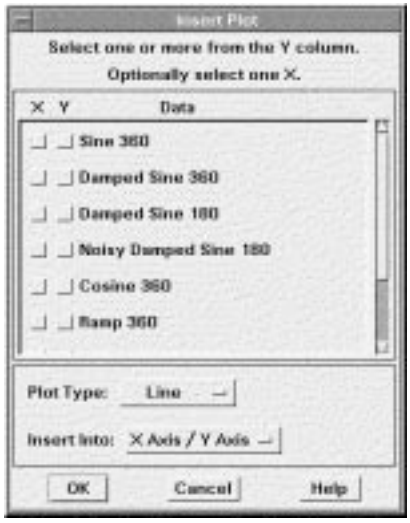


Figure 5-2: Insert Plot Dialog

Using the Insert Plot dialog

1. Select data by selecting the "Y" box to its left.
2. Select the "Plot Type" from the droplist: Scatter, Line, or Histogram.
3. Select the axes from the "Insert Into" droplist: New Axes or X Axis / Y Axis.

Note The choice "New Axes" is always available; however, the additional choices depend on what the axes are named, and how many sets of axes are present (e.g., "X Axis / Y Axis", "X Axis 001 / Y Axis 001", "Data Name 1 Axis / Data Name 2 Axis", "My Axis Name / My Other Axis Name", etc.)

Click "OK". The dialog closes and a Visualization of the selected data is inserted into the selected plot.

Apply Style

Select "Apply Style" to view a submenu of visualization styles of the same type as the selected visualization. Select a style to apply it to the selected visualization. To find out more about styles, see the "Save Style" option below and "About Styles" on page 100.

Save Style

Select this option to open the Save Visualization Style dialog, which allows you to save the data-independent properties of a selected Visualization as a style. Click in the "Name"

text field, and edit. The style will be saved in the project, and it will be listed as an option in the submenu of “Apply Style” (see above) when a visualization of the same type is selected. For more information, see “About Styles” on page 100.

Organizer

Select this option to open the Organizer dialog. The Organizer allows you to delete or rename items, as well as copy items between projects.

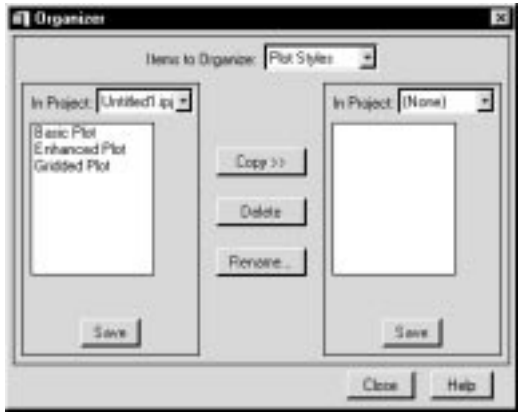


Figure 5-3: Organizer Dialog

Items to Organize Droplist

From this droplist, select the type of items you wish to organize: color tables, data items, plot styles, contour styles, image styles, or surface styles.

In Project Droplist

Choose one of the currently open projects from this droplist, “(None)” to clear this side of the Organizer, or “Other...” to bring up a native file browser in which to select a project which is not yet open in the Insight session.

Note You cannot select the same project on both sides of the Organizer.

Copy Button

Select a project item and choose this button to copy from one project to the other. You can copy from either right to left, or left to right.

Note If you copy an image data item that uses a particular color table, and the destination project does not yet contain a color table of that name, the color table will automatically be copied for you.

Delete Button
Select an item and use this button to delete it from the project.

Note Deletions cannot be undone.

Rename Button
Select an item and use this button to rename the item.

Save Button
Select this button to save the project to file.

Close Button
Select this button to close the Organizer.

Note You will automatically be prompted to save the project if you have made changes and did not hit the Save button.

Moving Visualizations and Elements

You can move Visualizations in two ways:

- Using the mouse, select a Visualization or element. Holding down the mouse, drag the element to the desired location, and release the mouse.
- Using the mouse, double-click on a Visualization to bring up the Properties dialog. (Alternatively, select the Visualization and use the Visualization Manager's "Edit" button to open the Properties dialog.) The Properties dialog allows you to enter a new location. For more information on changing properties, see "General Visualization Properties" on page 74.

Sizing Visualizations

To scale a Visualization, select it and use the Visualization's *scaling handles*. Using the mouse, select a Visualization. Scaling handles are located in the four corners of the Visualization's bounding box. Simply click a handle, hold down the mouse, drag until you reach the desired size, and release the mouse. The Visualization remains selected.

Rotating Surfaces

To rotate a surface displayed in the Visualization window, select the surface. Holding down the mouse, drag across the surface in the desired direction of rotation. When you reach the desired rotation, release the mouse.

Hint For non-solid surfaces, make sure you are clicking and dragging a point on the surface and not between points, which may result in another graphic element being selected. Be aware that complex Visualizations may severely tax your system's resources (see "Instance Drawing/Renderer Buttons" on page 24).

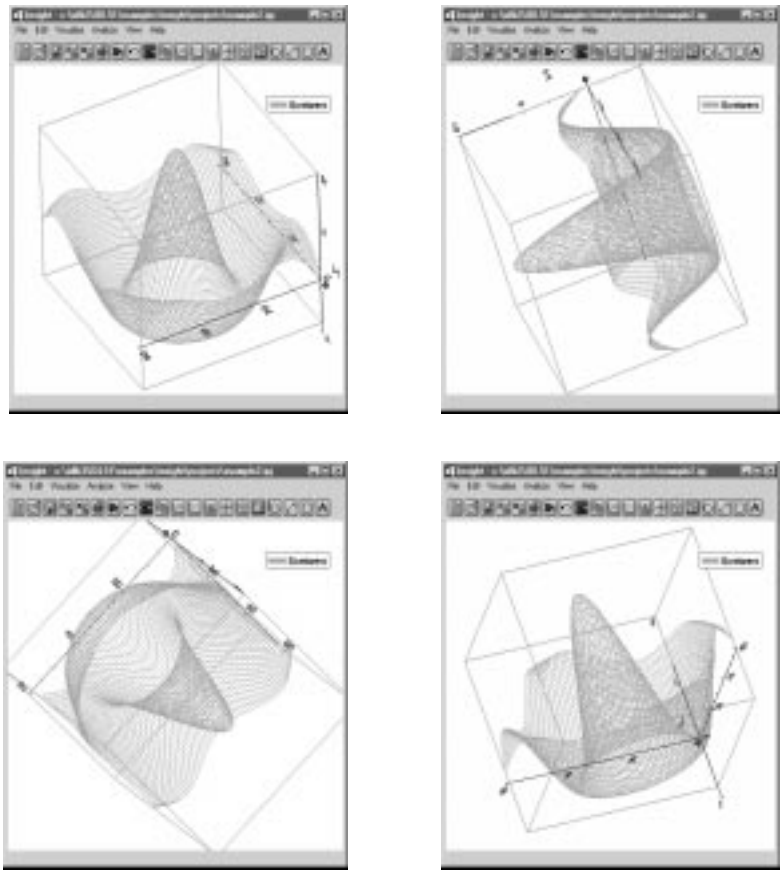


Figure 5-4: Rotating a surface by dragging the mouse: 4 different rotations

Properties (Visualizations)

Properties are characteristics of a Visualization that determine how it looks. A Properties dialog allows you to inspect and modify the unique properties of a Visualization or element *selected* in the Visualization window. Display a properties dialog either by double-clicking on the selected element or by selecting "<*Graphic*> Properties" from the Visualization window Edit menu. This section describes the dialog controls that represent those properties.

The Properties Dialogs

The Properties dialogs provide controls you can use to modify properties of selected elements or Visualizations. The controls displayed depend on the Visualization or element selected.

After you have finished viewing and modifying properties in the dialog, you can:
Click “Apply” to apply modifications as a trial. This option is helpful when you want to see how various changes modify the Visualization in the window before accepting them. You can click “Apply” as many times as you wish. The Properties dialog remains open.

When you’re ready to accept the property changes, click “OK”. The Properties dialog closes.

General Visualization Properties

When you select an entire Visualization, Visualization Properties dialog controls which allow you to modify properties common to all Visualization types (Line, Scatter, Histogram, and Polar plot; Contour, Image, and Surface) appear in the Visualization Properties dialog. This section describes these dialog controls and how to use them.

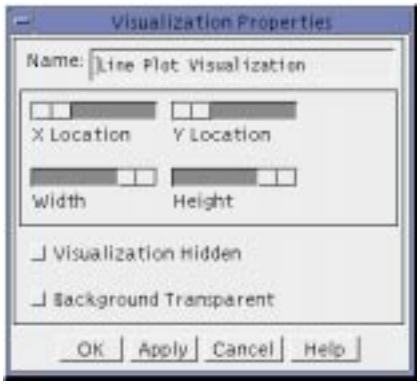


Figure 5-5: Properties Dialog for Visualization Characteristics

Name Text Field

A Visualization is identified by its *name*. Insight refers to the name whenever a Visualization needs to be referenced textually (for example in lists or for processing error messages). A name is required and must be unique within the Insight application.

To enter a new name, click in the “Name” text field and edit the name.

X Location Slider

Use the “X Location” slider to modify the X location of the Visualization in the window.

Y Location Slider

Use the “Y Location” slider to modify the Y location of the Visualization in the window.

Width Slider

Use the “Width” slider to modify the width of the entire Visualization relative to the dimensions of the Visualization window. Adjust the slider value by clicking in its bar or dragging its knob to the desired width. Moving the knob to the left decreases the width.

Height Slider

Use the “Height” slider to modify the height of the entire Visualization relative to the dimensions of the Visualization window. Adjust the slider value by clicking in its bar or dragging its knob to the desired height. Moving the knob to the left decreases the height.

Note You also can manipulate Visualizations directly using the mouse. “Moving Visualizations and Elements” on page 72.

Visualization Hidden Checkbox

Select the “Visualization Hidden” checkbox to hide the selected Visualization from view. This option is helpful when you are working with several Visualizations in the window and you do not want to re-draw all of the Visualizations each time a modification is made. Hidden Visualizations are not removed from the Visualization window.

Background Transparent Checkbox

Select the “Background Transparent” checkbox to change the selected Visualization's background from white to clear. Use this option to overlay one Visualization on top of another and view both at the same time. For example, if a contour is placed over an image Visualization, the image will be obscured unless the contour’s background is transparent.

Properties Dialog for Plot Lines of a Line Plot Visualization

When you select a plot line in the Visualization window, dialog controls appear in the Properties dialog allowing you to modify properties of the line plot. This section describes the dialog controls and how to use them.

Name Text Field

A plot element is identified by its *name*. Insight refers to the name whenever a plot element needs to be referenced textually (for example in lists or for processing error messages). A name is required and must be unique within the Insight application.

To enter a new name, click in the “Name” text field and edit the name.

Minimum Value Slider and Text Field

Use the “Minimum Value” slider or text field to limit the value of the data you plot. Data values less than this value are not plotted. The default value is the minimum value of the data.

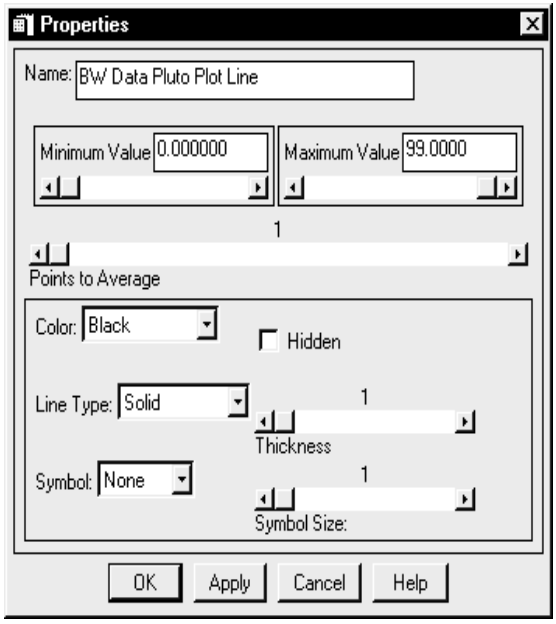


Figure 5-6: Properties Dialog for a Line Plot

Maximum Value Slider and Text Field

Use the "Maximum Value" slider or text field to limit the value of the data you plot. Data values larger than this value are not plotted. The default value is the maximum value of the data.

Points To Average Slider

Use the "Points to Average" slider to designate the number of points that Insight should average when plotting. Adjust the slider value by clicking in its bar or dragging its knob to the desired number. The number is displayed above the slider. Numbers range from one to the number of points in the data.

Color Droplist

From the "Color" droplist, select a color for the line. This option is particularly useful when working with several plots in the Visualization window, allowing you to easily distinguish each.

Hidden Checkbox

Select this option to hide the selected element from view.

Note To make a hidden graphic element visible: Select the Visualization Manager option from the Edit menu. The Visualization Manager Window appears listing all elements

of all Visualizations. Select the hidden element and click the “Edit” button. In the Properties dialog, deselect the Hidden option.

Line Type Droplist

From the “Line Type” droplist, select a type for the line. Options are: solid, dotted, dashed, dash dot, dash dot dot, and long dashes. This option is particularly useful when working with several plots in the Visualization window, allowing you to easily distinguish each.

Thickness Slider

Use this slider to designate the thickness of the line. Adjust the slider value by clicking in its bar or dragging its knob to the desired thickness. The range is from 1 to 10 pixels. The thickness is displayed above the slider. This option is particularly useful when working with several lines in the Visualization window, allowing you to easily distinguish each.

Symbol Droplist

From the “Symbol” droplist, select a plotting symbol. Options are: plus, asterisk, period, diamond, triangle, square, and X. If you do not want a symbol, select “None”.

Plotting symbols mark each data point in a plot. This option is particularly useful when working with several plots in the Visualization window, allowing you to easily distinguish each.

Note The “Symbol” droplist is unavailable for histogram plots.

Symbol Size Slider

Use this slider to designate symbol size. Adjust the slider value by clicking in its bar or dragging its knob to the desired size. The range is from 1 to 10 (percent of Visualization size). The size is displayed above the slider.

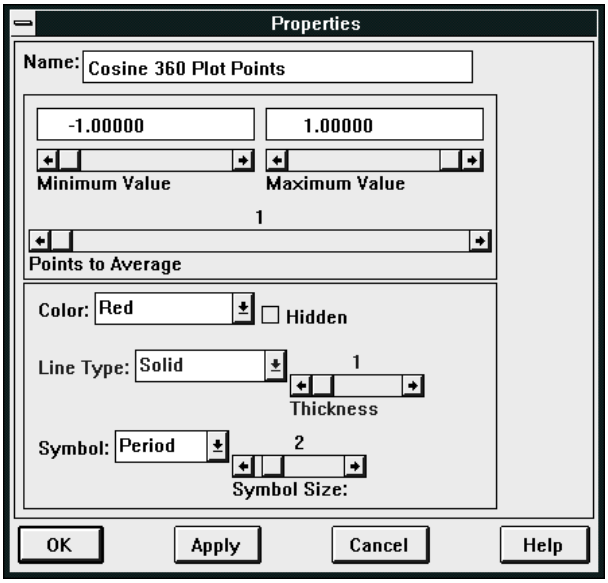


Figure 5-7: Properties Dialog for a Scatter Plot

Properties Dialog for Scatter Plots

When you select symbols of a scatter plot in the Visualization window, dialog controls appear in the Properties dialog allowing you to modify properties of the scatter plot. This section describes the dialog controls and how to use them.

Fields in the Scatter Plot Properties Dialog

The Scatter Plot Properties Dialog has the same fields as the Line Plot Properties dialog, described in “Properties Dialog for Plot Lines of a Line Plot Visualization” on page 75. The “Line Type” and “Thickness” options are not available for Scatter plots.

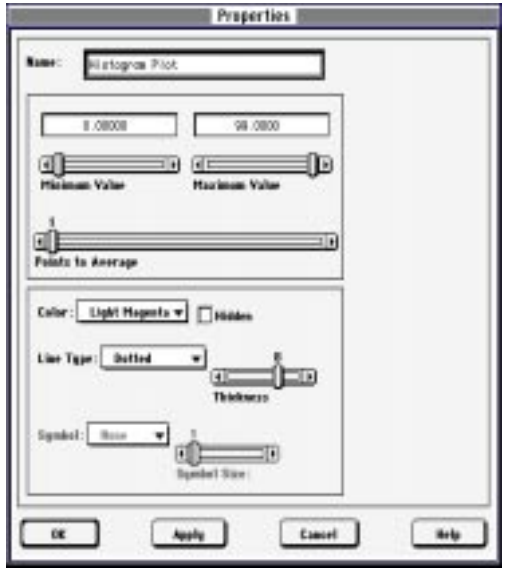


Figure 5-8: Properties Dialog for a Histogram Plot

Properties Dialog for Histogram Plots

When you select a histogram plot in the Visualization window, dialog controls appear in the Properties dialog allowing you to modify properties of the histogram plot. This section describes the dialog controls and how to use them.

Fields in the Histogram Plot Properties Dialog

The Histogram Plot Properties Dialog has the same fields as the Line Plot Properties dialog, described in “Properties Dialog for Plot Lines of a Line Plot Visualization” on page 75. The “Symbol” and “Symbol Size” options are not available for Histogram plots.

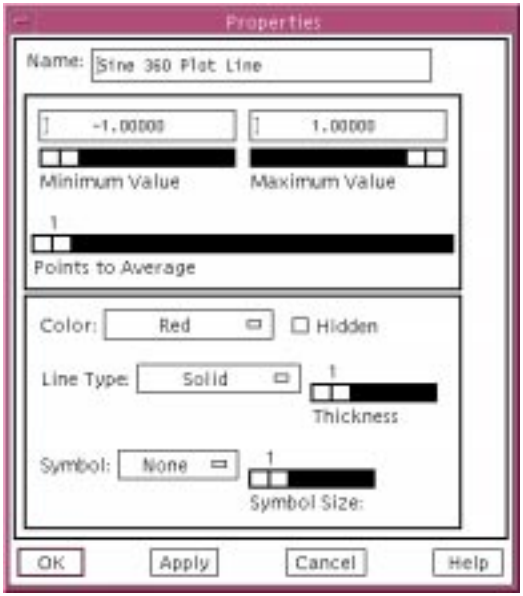


Figure 5-9: Properties Dialog for a Polar Plot

Properties Dialog for Polar Plots

When you select a polar plot in the Visualization window, dialog controls appear in the Properties dialog allowing you to modify properties of the polar plot. This section describes the dialog controls and how to use them.

Fields in the Polar Plot Properties Dialog

The Polar Plot Properties Dialog has the same fields as the Line Plot Properties dialog, described in “Properties Dialog for Plot Lines of a Line Plot Visualization” on page 75.

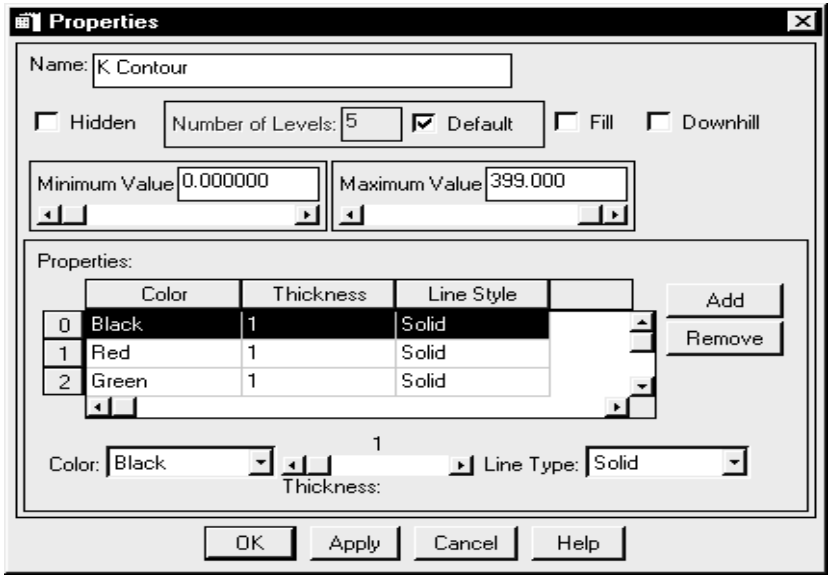


Figure 5-10: Properties Dialog for Contours

Properties Dialog for Contours

When you select a contour in the Visualization window, dialog controls appear in the Properties dialog allowing you to modify properties of contours. This section describes the dialog controls and how to use them.

Name Text Field

A contour is identified by its *name*. Insight refers to the name whenever a contour needs to be referenced textually (for example in lists or for processing error messages). A name is required and must be unique within the Insight application.

To enter a new name, click in the “Name” text field and edit the name.

Hidden Checkbox

Select this option to hide the selected element from view.

Note To make a hidden graphic element visible: Select the Visualization Manager option from the Edit menu. The Visualization Manager Window appears listing all elements of all Visualizations. Select the hidden element and click the “Edit” button. In the Properties dialog, deselect the Hidden option.

Number of Levels Text Field

Enter the number of contour levels desired in the “Number of Levels” text field. Insight draws a contour in each level of the Visualization based on the level characteristics

specified in the “Properties” table. For example, if you specify five contour levels in the “Number of Levels” text field and only two levels are listed in the Properties Table, Insight draws the contours in the following order: level 1, level 2, level 1, level 2, level 1 (from the outside of the contour in).

Default Checkbox
Click on this box to set the default in the Number of Levels text field.

Fill Checkbox
Select this option to fill the contours with solid colors.

Downhill Checkbox
Select this option to make the contour lines point “downhill” toward the lower-valued data.

Minimum/Maximum Values
Enter the minimum/maximum values of the contour range to be displayed.

Properties Table
The Properties table lists contour levels along with the color, thickness and line style properties of each. Use the table to select contour level you’d like to modify using other dialog controls. For example, by selecting a level listed in the table and clicking “Add”, Insight adds the duplicate contour to the table list.

Add Button
After selecting a level in the “Properties” table, click “Add” to duplicate the selected level. Insight adds the duplicate contour level properties to the table list.

Remove Button
After selecting a level in the “Properties” table, click “Remove” to remove a selection in the “Properties” table. Insight removes the level from the table list.

Color Droplist
After selecting a level in the “Properties” table, select a color from the “Color” droplist.

Thickness Slider
After selecting a level in the “Properties” table, use this slider to designate the thickness of the level. Adjust the slider value by clicking in its bar or dragging its knob to the desired thickness. The range is 1 to 10 pixels. The thickness is displayed above the slider.

Line Type Droplist
After selecting a level in the “Properties” table, select a line type from the “Line Type” droplist. Options are: solid, dotted, dashed, dash dot, dash dot dot, and long dashes.

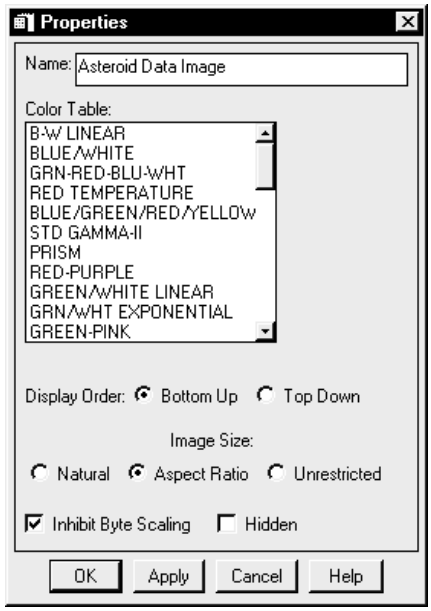


Figure 5-11: Properties Dialog for an Image

Properties Dialog for Images

When you select an image in the Visualization window, dialog controls appear in the Properties dialog allowing you to modify properties of the image. This section describes the dialog controls and how to use them.

Name Text Field

An image is identified by its *name*. Insight refers to the name whenever an image needs to be referenced textually (for example in lists or for processing error messages). A name is required and must be unique within the Insight application.

To enter a new name, click in the “Name” text field and edit the name.

Color Table List

From the “Color Table” list, select the color table desired. This option is available for indexed color images and is not available for true color images.

Display Order Options

Select “Bottom Up” or “Top Down”. to specify the order in which the image should be displayed.

Image Size Options

Select “Natural”, “Aspect Ratio”, or “Unrestricted” to specify image size in the Visualization window.

- Select “Natural” to restrict the image size in the Visualization window to the width and height of the image data. The image displayed will not change size and will be an accurate display of the image data. Note that with a natural image size, the resulting image maybe too small or too large to work with.
- Select “Aspect Ratio” so that the image maintains the same aspect ratio as the image data whenever the image is sized. Note that with “Aspect Ratio”, Insight must scale the image and interpolate the image data which diminishes image accuracy.
- Select “Unrestricted” so that the image has the width and height of the Visualization that contains it. Note that selecting an unrestricted image size could distort how the image appears.

Inhibit Byte Scaling Checkbox

Select “Inhibit Byte Scaling” to prevent Insight from automatically scaling the array to enhance its contrast. Insight automatically turns this option “on” for images that were imported into Insight with color tables. Insight automatically turns this option “off” for indexed color images without color tables, true-color images, and for arrays of non-image data.

Hidden Checkbox

Select this option to hide the selected element from view.

Note To make a hidden graphic element visible: Select the Visualization Manager option from the Edit menu. The Visualization Manager Window appears listing all elements of all Visualizations. Select the hidden element and click the “Edit” button. In the Properties dialog, deselect the Hidden option.

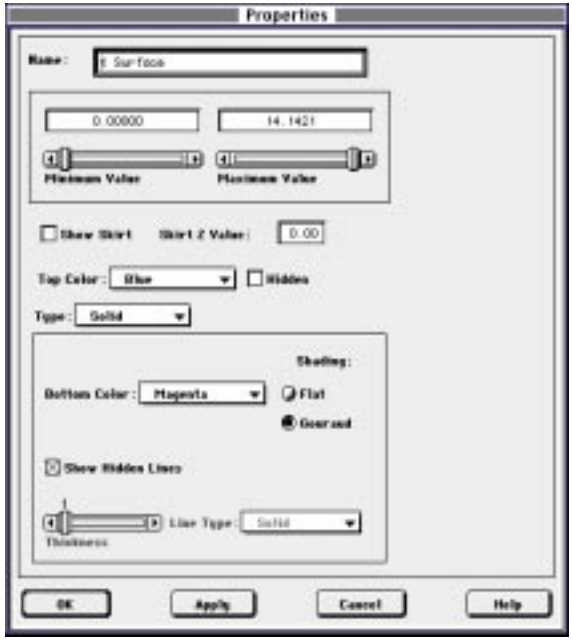


Figure 5-12: Properties Dialog for Surfaces

Properties Dialog for Surfaces

When you select a surface in the Visualization window, dialog controls appear in the Properties dialog allowing you to modify properties of the surface. This section describes the dialog controls and how to use them.

Name Text Field

A surface is identified by its *name*. Insight refers to the name whenever a surface needs to be referenced textually (for example in lists or for processing error messages). A name is required and must be unique within the Insight application.

To enter a new name, click in the “Name” text field and edit the name.

Minimum Value Slider and Text Field

Use the “Minimum Value” slider or text field to limit the data you display. Data values less than this value are not displayed. The default value is the minimum value of the data.

Maximum Value Slider and Text Field

Use the “Maximum Value” slider or text field to limit the data you display. Data values larger than this value are not displayed. The default value is the maximum value of the data.

Show Skirt Checkbox
Select “Show Skirt” to display a “skirt” around the surface at the given Z value.

Skirt Z Value Text Field
Enter the value at which the skirt around the surface will be displayed in the “Skirt Z Value” text field. The Z value is expressed in data units.

Top Color Droplist
From the “Top Color” droplist, select a color for the upper side of the surface. This is the only color used if the surface type is not “Solid”.

Hidden Checkbox
Select this option to hide the selected element from view.

Note To make a hidden graphic element visible: Select the Visualization Manager option from the Edit menu. The Visualization Manager Window appears listing all elements of all Visualizations. Select the hidden element and click the “Edit” button. In the Properties dialog, deselect the Hidden option.

Type of Surface Droplist
From the “Surface Type” droplist, select the desired style for displaying the visible surface. Options include: Point, Mesh (wire), Ruled (XZ), Ruled (YZ), Lego (wire), and Lego (solid). Lego (wire), and Lego (solid) produce stacked histogram-style plots. Each data value is rendered as a box covering the XY extent of the cell and with a height proportional to the Z value.

Bottom Color Droplist
From the “Bottom Color” droplist, select a color for the underside of the surface. This option is only available for solid surfaces.

Shading Options
Select “Flat” or “Gouraud” to specify the shading style of Solid or Lego (solid) type surfaces. Gouraud shading interpolates intensities from each vertex along each edge of a surface. While it is slower, Gouraud shading usually results in a smoother appearance.

Show Hidden Lines Checkbox
Select the “Show Hidden Lines” checkbox to draw lines that are “behind” other lines in the surface. Not showing hidden lines will increase the time it takes to display a surface. This option is not available if the surface type is “Solid”.

Line Type Droplist
From the “Line Type” droplist, select a type for the line. Options are: solid, dotted, dashed, dash dot, dash dot dot, and long dashes. This option is particularly useful when working with several plots in the Visualization window, allowing you to easily distinguish each. This option is not available if the surface type is “Solid”.

Thickness Slider

Use this slider to designate the thickness of the line. Adjust the slider value by clicking in its bar or dragging its knob to the desired thickness. The range is from 1 to 10 pixels. The thickness is displayed above the slider. This option is particularly useful when working with several lines in the Visualization window, allowing you to easily distinguish each. This option is not available if the surface type is “Solid”.

Properties Dialog for Axes

When you select an axis in the Visualization window, dialog controls appear in the Properties dialog allowing you to modify properties of the axis. This section describes dialog controls for each type of axis: X, Y, Z, radius, and Theta.

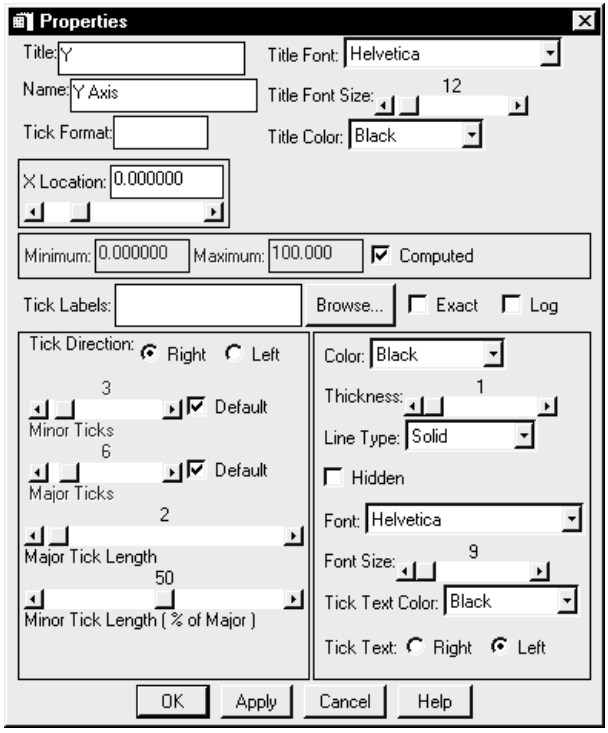


Figure 5-13: Properties Dialog for Axes

Title Text Field

Enter the text of the axis title in the “Title” text field. Note that the title of an axis is different from its *Name*.

Name Text Field

An axis is identified by its *name*. Insight refers to the name whenever an axis needs to be referenced textually (for example in lists or for processing error messages). A name is required and must be unique within the Insight application.

To enter a new name, click in the “Name” text field and edit the name.

Tick Format

Allows you to specify a format string (minus the parentheses) to determine the format of the tick text. Blank is the default. For more information, see Format Codes in *Using IDL*.

Title Font Droplist

Select a font to use for the axis title from the “Title Font” droplist.

Title Font Size Slider

Select a size for the axis title using the “Title Font Size” slider.

Title Color Droplist

From the “Title Color” droplist, select the title text color.

[XYZ] Location Text Fields and Sliders

Adjust the sliders or type in the text fields to set the axis location in data units.

Minimum/Maximum

Enter values into the Minimum/Maximum boxes to designate the minimum/maximum range of the selected axis. The Minimum/Maximum range has the effect of zooming in/out.

Computed Checkbox

Select the Computed option to allow the axis minimum/maximum ranges to be computed automatically based on the min/max of the data sets associated with the axes.

Tick Labels Browse Menu

Use this menu to browse the selection of data that can be used as tick labels.

Exact Checkbox

Select the “Exact” option to make the data range of the axis the minimum and maximum data values of the data being visualized. If this box is not checked, Insight may adjust the range of the axis to fit the tickmark increment. Changing the axis range does not change the way data is displayed, only how the axis is displayed.

Log Checkbox

Select Log to display the data as a log plot.

Tick Direction Options

Select the desired direction for the tick marks on the selected axis (X axis: “Up” or “Down”; Y axis: “Left” or “Right”).

Minor Ticks Slider
Use this slider to designate the number of minor tick marks between major tick marks. Adjust the slider value by clicking in its bar or dragging its knob to the desired length.

Major Ticks Slider
Use this slider to designate the number of major tick marks along the axis. Adjust the slider value by clicking in its bar or dragging its knob to the desired length.

Default Checkboxes
Resets the Minor/Major Ticks to default values.

Tick Length Slider
Use the “Tick Length” slider to designate the length of the tick marks along the axis. Adjust the slider value by clicking in its bar or dragging its knob to the desired length (0-100% of Visualization).

Color Droplist
From the “Color” droplist, select a color for the axis.

Thickness Slider
Use this slider to designate the thickness of the axis. Adjust the slider value by clicking in its bar or dragging its knob to the desired thickness. The number is displayed above the slider. Numbers range from 1 to 10 pixels.

Line Type Droplist
From the “Line Type” droplist, select a line type for the tick marks. Options are: solid, dotted, dashed, dash dot, dash dot dot, and long dashes.

Hidden Checkbox
Select this option to hide the selected element from view.

Note To make a hidden graphic element visible: Select the Visualization Manager option from the Edit menu. The Visualization Manager Window appears listing all elements of all Visualizations.Select the hidden element and click the “Edit” button. In the Properties dialog, deselect the Hidden option.

Font Droplist
Select a font to use for the axis tick marks from the droplist.

Font Size Slider
Select a size for the axis tick marks using the “Font Size” slider.

Tick Text Color Droplist
Select a color for the Tick Text with this menu.

Tick Text Location
Place the Tick Text by selecting Right or Left (x axis) or Top or Bottom (y axis).

Properties Dialogs for Annotations

To edit an annotation, either double-click on it or use the Edit/<graphic> Properties menu. The dialog will have different properties depending on the type of annotation selected (Colorbar, Legend, Line, Rectangle, or Text). This section describes dialog controls for each Insight annotation type.

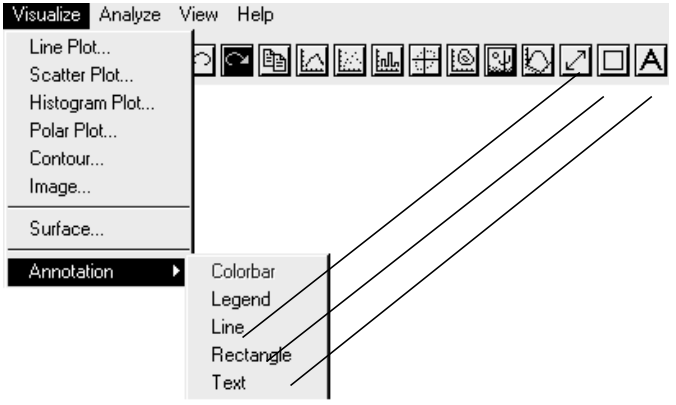


Figure 5-14 Creating an Annotation from the "Visualize" Menu or from the Visualization toolbar (Note: Only Line, and Text are available from the toolbar).

Colorbar Annotation

Colorbars will automatically be generated with grayscale or color images when an image Visualization is created. The color bar will correspond to the palette of the image. When you select "Colorbar" from the "Annotation" cascading menu and click on the colorbar, the following properties dialog appears.

Title Text Field

Enter the colorbar title in the "Title" text field. Note that a colorbar title is different from its *Name*.

Title Font Droplist

From the "Title Font" droplist, select a font for the title text.

Title Font Size Slider

Adjust the "Title Font Size" slider to the desired character size (9-72 points) for the title text.

Title Color Droplist

From the "Title Color" droplist, select the title text color.

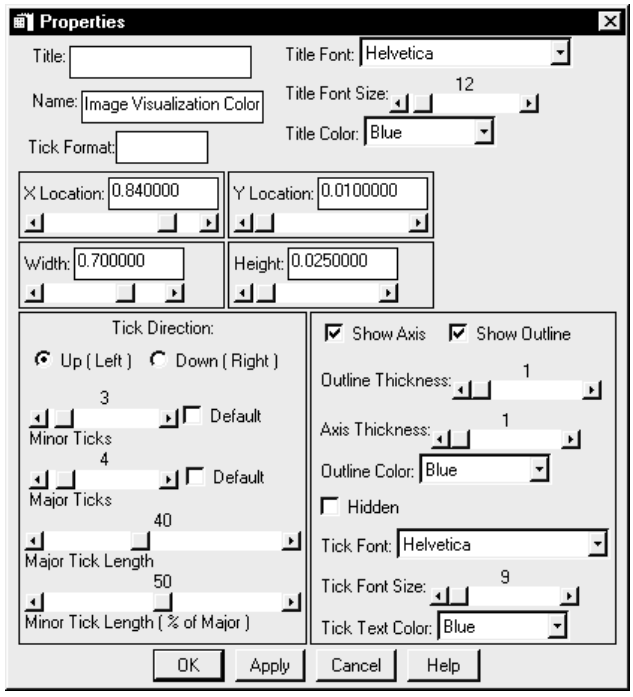


Figure 5-15: Properties Dialog for Colorbar Annotati

Name Text Field

An annotation is identified by its *name*. Insight refers to the name whenever an annotation needs to be referenced textually (e.g., in lists or for processing error messages). A name is required and must be unique within the Insight application.

To enter a new name, click in the “Name” text field and edit the name.

Tick Format

Allows you to specify a format string (minus the parentheses) to determine the format of the tick text. Blank is the default. For more information, see Format Codes in *Using IDL*.

X and Y Location Sliders

Use the “X Location” and “Y Location” sliders to designate the X and Y location of the colorbar. Adjust the slider value by clicking in its bar or dragging its knob to the desired location. Moving the slider to the left and right moves the colorbar up or down in the Visualization window.

X Slider: left=left, right=right

Y Slider: left=down, right=up

Width and Height Sliders
Use the “Width” and “Height” sliders to designate the width and height of the colorbar.

Note If the width is greater than the height, the colorbar is horizontal; if the height is greater than the width, the colorbar is vertical.

Tick Direction Options
Select the desired direction for the tick marks (“Up” or “Down”).

Minor Ticks Slider
Use this slider to designate the number of minor tick marks between major tick marks. Adjust the slider value by clicking in its bar or dragging its knob to the desired length.

Major Ticks Slider
Use this slider to designate the number of major tick marks along the colorbar axis. Adjust the slider value by clicking in its bar or dragging its knob to the desired length.

Major Tick Length Slider
Use this slider to designate the length of the major tick marks. Adjust the slider value by clicking in its bar or dragging its knob to the desired length (0 - 100% of Visualization dimensions).

Minor Tick Length Slider
Use this slider to designate the length of the minor tick marks as a percent of the major tick marks. Adjust the slider value by clicking in its bar or dragging its knob to the desired length (0-100% of major tick marks).

Show Axis Option
Select this option to show the axis of the colorbar.

Show Outline Option
Selection this option to show the outline of the colorbar.

Outline Thickness Slider
Use this slider to set the thickness of the colorbar outline. Numbers range from 1 to 10 pixels.

Axis Thickness Slider
Use this slider to set the thickness of the colorbar axis. Numbers range from 1 to 10 pixels.

Outline Color Droplist
From the “Color” droplist, select a color for the colorbar outline/axis.

Hidden Checkbox
Select this option to hide the colorbar from view.

Note To make a hidden annotation visible: Select the Visualization Manager option from the Edit menu. The Visualization Manager Window appears listing all Visualizations, annotations and elements. Select the hidden element and click the "Edit" button. In the Properties dialog, deselect the Hidden option.

Tick Font Droplist

From the "Tick Font" droplist, select a tick font for the colorbar.

Tick Font Size Slider

Adjust the "Tick Font Size" slider to the desired character size (9-72 points).

Tick Text Color Droplist

From the "Tick Text Color" droplist, select the tick text color.

Legend Annotation

Legends will be generated when a plot, contour or surface graph is created. To edit a legend, either double-click on it or use the Edit/<graphic> Properties menu. This section describes dialog controls for each Insight annotation type.

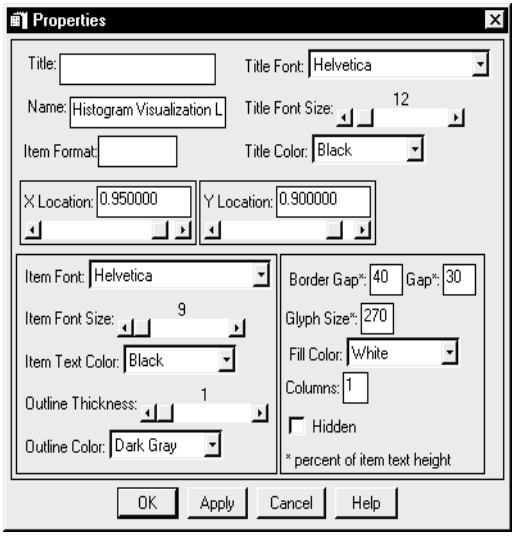


Figure 5-16: Properties Dialog for Legend Annotation

Title Text Field

Enter the title in the "Title" text field. Note that a legend title is different from its *Name*.

Title Font Droplist

From the "Title Font" droplist, select a font for the title text.

Title Font Size Slider
Adjust the “Title Font Size” slider to the desired character size (9-72 points) for the title text.

Title Color Droplist
From the “Title Color” droplist, select the title text color.

Name Text Field
An annotation is identified by its *name*. Insight refers to the name whenever an annotation needs to be referenced textually (for example in lists or for processing error messages). A name is required and must be unique within the Insight application.

To enter a new name, click in the “Name” text field and edit the name.

Item Format
Allows you to specify a format string (minus the parentheses) to determine the format of contour legends. Blank is the default. For more information, see Format Codes in *Using IDL*.

Note Item Format is used only for contour legends.

X and Y Location Sliders
Use the “X Location” and “Y Location” sliders to designate the X and Y location of the legend. Adjust the slider value by clicking in its bar or dragging its knob to the desired location. Moving the slider to the left and right moves the legend up or down in the Visualization window.

X Slider: left=left, right=right

Y Slider: left=down, right=up

Item Font Droplist
From the “Item Font” droplist, select the desired item font for the legend. The item corresponds to the text next to they glyph in the legend.

Item Font Size Slider
Use this slider to adjust the size of the font. The range is from 9 to 72 points.

Item Text Color Droplist
From the “Item Text Color” droplist, select the desired color for the text.

Outline Thickness Slider
Use this slider to adjust the thickness of the legend outline.

Outline Color Droplist
From the “Outline Color” droplist, select the desired color for the outline of the legend.

Border Gap
Set the distance between the text and the legend border by entering a number here (units are percent of item text height).

Gap
Set the distance between each item text with this number (units are percent of item text height).

Glyph Size
Set this number to the desired size of the reference symbol.

Fill Color Droplist
From the “Fill Color” droplist, select a background color for the legend.

Columns
Set the number of columns for the item.

Hidden Checkbox
Select this option to hide the legend from view.

Note To make a hidden annotation visible, first select the Visualization Manager option from the Edit menu. The Visualization Manager Window appears listing all Visual-

izations, annotations and elements. Select the hidden element and click the “Edit” button. In the Properties dialog, deselect the Hidden option.

Line Annotation

To edit a line annotation, either double-click on it or use the Edit/<graphic> Properties menu.

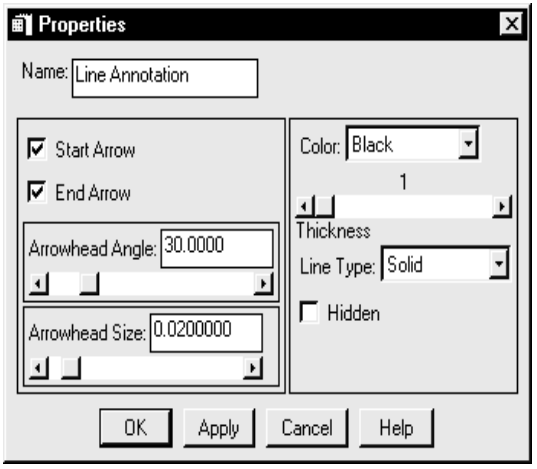


Figure 5-17: Properties Dialog for Line Annotation

Name Text Field

An annotation is identified by its *name*. Insight refers to the name whenever an annotation needs to be referenced textually (for example in lists or for processing error messages). A name is required and must be unique within the Insight application.

To enter a new name, click in the “Name” text field and edit the name.

Start Arrow Checkbox

Select this option to display an arrow at the starting point of a line annotation.

End Arrow Checkbox

Select this option to add an arrow to the ending point of a line annotation.

Arrowhead Angle Slider

Use this slider to designate the angle of the line annotation’s arrowhead(s). Adjust the slider value by clicking in its bar or dragging its knob to the desired angle.

Arrowhead Size Slider

Use this slider to designate the size of the line annotation’s arrowhead(s). Adjust the slider value by clicking in its bar or dragging its knob to the desired size (units = size x 100% of Visualization dimensions).

Color Droplist
From the “Color” droplist, select a color for the line.

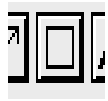
Thickness Slider
Use this slider to designate the thickness of the annotation. Adjust the slider value by clicking in its bar or dragging its knob to the desired thickness. The number is displayed above the slider. Numbers range from 1 to 10 pixels.

Line Type Droplist
From the “Line Type” droplist, select a line type for the line. Options are: solid, dotted, dashed, dash dot, dash dot dot, and long dashes.

Hidden Checkbox
Select this option to hide the line from view.

Note To make a hidden annotation visible: Select the Visualization Manager option from the Edit menu. The Visualization Manager Window appears listing all Visualizations, annotations and elements. Select the hidden element and click the “Edit” button. In the Properties dialog, deselect the Hidden option.

Rectangle Annotation
To edit a rectangle annotation, either double-click on it or use the Edit/<graphic> Properties menu.



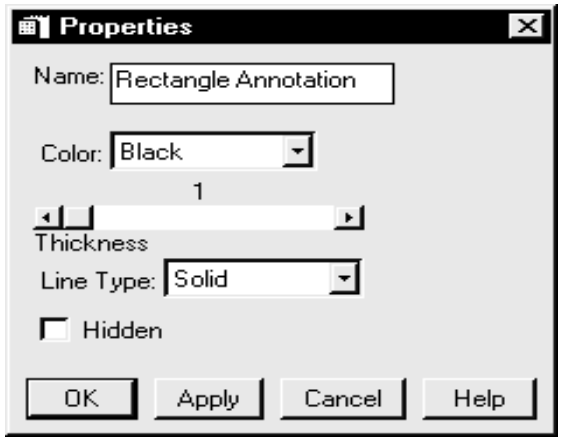


Figure 5-18: Properties Dialog for Rectangle Annotation

Name Text Field
An annotation is identified by its *name*. Insight refers to the name whenever an annotation needs to be referenced textually (for example in lists or for processing error messages). A name is required and must be unique within the Insight application.

To enter a new name, click in the “Name” text field and edit the name.

Color Droplist
From the “Color” droplist, select a color for the rectangle.

Thickness Slider
Use this slider to designate the thickness of the rectangle. Adjust the slider value by clicking in its bar or dragging its knob to the desired thickness. The number is displayed above the slider. Numbers range from 1 to 10 pixels.

Line Type Droplist
From the “Line Type” droplist, select a line type for the rectangle. Options are: solid, dotted, dashed, dash dot, dash dot dot, and long dashes.

Hidden Checkbox
Select this option to hide the rectangle from view.

Note To make a hidden annotation visible: Select the Visualization Manager option from the Edit menu. The Visualization Manager Window appears listing all Visualizations, annotations and elements. Select the hidden element and click the “Edit” button. In the Properties dialog, deselect the Hidden option.

Text Annotation

To edit a text annotation, either double-click on it or use the Edit/<graphic> Properties menu.

Text Field
Enter the annotation text in the “Text” text field. Multiple line entries are allowed. Note that the text may be an “annotation formula” which should follow these general rules:

- Each line of the annotation is parsed once, left to right, for vertical bars (|).
- Two vertical bars surrounding a data item name will be replaced by the corresponding data value(s), possibly requiring multiple lines.
- Two adjacent bars will be replaced by a single bar.
- Two bars surrounding text that is not a data item name will be left as is.

Browse
Use browse to select a data item for the “Text” field.

Note You can enter the name of a data item (found in the data manager) into the “Text” field. The name must be delimited by bars (“|”). The name will be used to get the data value which is then inserted as a string into the text annotation (the bars are not included in the resultant text annotation). For example, assume there is a data item named “Text Header” that is a textual description of data read in from a file. The content of Text Header is “This is a long explanation of my data”. This text string could be used as a text annotation by simply entering |Text Header| as the text value of the annotation.

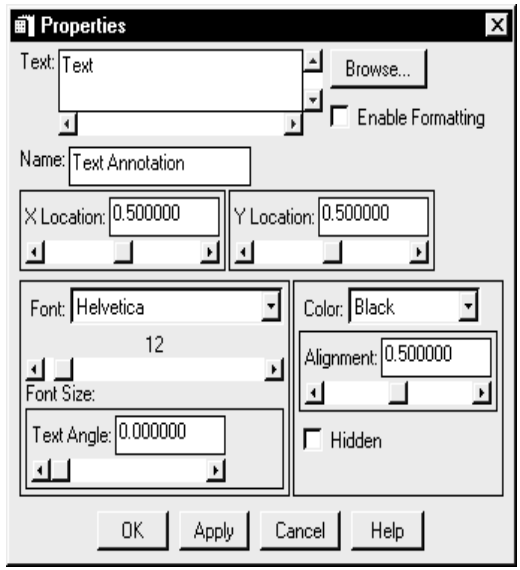


Figure 5-19: Properties Dialog for Text Annotation

Enable Formatting

If set, this will interpret "!" to be the font and sizing commands. For more information, see fonts in *Using IDL*.

Name Text Field

An annotation is identified by its *name*. Insight refers to the name whenever an annotation needs to be referenced textually (for example in lists or for processing error messages). A name is required and must be unique within the Insight application.

To enter a new name, click in the "Name" text field and edit the name.

X and Y Location Sliders

Use the "X Location" and "Y Location" sliders to designate the X and Y location of the annotation. Adjust the slider value by clicking in its bar or dragging its knob to the desired location. Moving the slider to the left and right moves the annotation up and down in the Visualization window.

X Slider: left=left, right=right

Y Slider: left=down, right=up

Font Droplist

From the "Font Type" droplist, select a font for a text annotation.

Font Size Slider
Adjust the "Font Size" slider to the desired character size (9-72 points) for a text annotation.

Text Angle Text Field and Slider
Enter the angle of rotation for a text annotation in the "Text Angle" text field or adjust the slider to the desired angle of rotation.

Color Droplist
From the "Color" droplist, select a color for the text annotation.

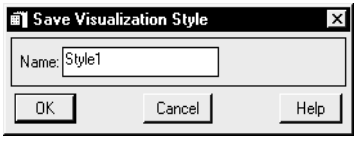
Alignment Slider
Adjust the slider to the desired alignment (0 to 1). A setting of zero aligns the text on the right, an alignment of one aligns it on the left. The default alignment (0.5) centers the text.

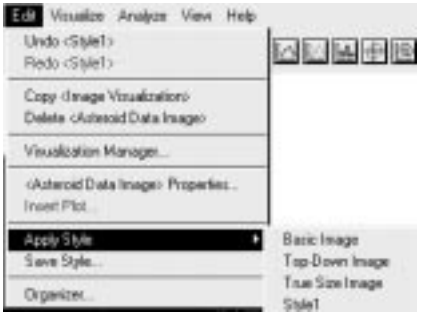
Hidden Checkbox
Select this option to hide the text annotation from view.

Note To make a hidden annotation visible: Select the Visualization Manager option from the Edit menu. The Visualization Manager Window appears listing all Visualizations, annotations and elements. Select the hidden element and click the "Edit" button. In the Properties dialog, deselect the Hidden option.

About Styles

Insight allows you to save sets of Visualization properties in a *style*. A style is just a list of Visualization attributes — colors, line styles, fonts, etc. — that can be associated with any Visualization of a given type.





To create a style, you select a Visualization or Visualization element, modify its properties, and click "OK" in the properties dialog. With the same Visualization still selected, select "Save Style" from the Edit menu. You will be prompted for a style name. When you click "OK", your new style will be added to the current project. It will appear in the "Apply Style" submenu of the Edit menu the next time you create a Visualization of the same type.

Note The style you create is only applicable to other Visualizations of the same type. If you create a style for a line plot, for example, that style will only be available to apply to other plot type Visualizations. You cannot apply a line plot style to a surface.

To add your styles to the Insight template file, open the template file, create the style, and save the project. See “New Project Menu Option” on page 19 for more on the location of the Insight template file.

Chapter 6

Analyzing Data

The following topics are covered in this chapter:

What is Data Analysis in Insight? 104
The Analyze Menu 104
Correlation 105
Curve Fitting 119
Image Processing 132
Smoothing 147
The Formulator 152
PlugIns 162

This chapter introduces data analysis with Insight and tells you how to use Analyze menu options to correlate data, fit curves, process images, smooth data, use the formulator, and use Analysis PlugIns.

What is Data Analysis in Insight?

Insight has incorporated IDL analysis capabilities into the Analyze menu and dialog selections. As you work on technical problem solving, you can use Analyze menu options to analyze existing data, visualize analysis results, and generate output data. Built-in analysis functionality may be augmented by user-written Analysis Plugins (see “Analysis PlugIns” on page 212 for more information).

Note To view new or existing data and attributes, open the Data Manager window by selecting the “Data Manager” menu option from the File menu. As a shortcut, you can click the Data Manager button on the Visualization toolbar. To find out more about the Data Manager window, see Chapter 3 (Working With Data).

Using the Visualization Window

You can use the Visualization window as an Analysis tool in several ways:

- To Visualize from Analysis - Analysis modules that support visualization will have visualization options in the OUTPUTS section of their dialogs. The details of such options are described below.
- To Automatically Select Data - If a plot line, contour, image, or surface is selected before entering an analysis module, the name of the corresponding data item will automatically be inserted into the appropriate input text widget of the analysis dialog.
- To Permit Visualization Inserts - Select any element of a visualization before entering an analysis module to enable inserting into that visualization.

The Analyze Menu

The Analyze menu provides options for performing data analysis and generating data. This menu also gives you access to an advanced data calculator called the *Formulator*(see “The Formulator” on page 152) and a submenu of *Analysis PlugIns (*see “Analysis PlugIns” on page 212 for more information).

Note You can add an analysis operation to Insight by writing an Analysis PlugIn that performs your own special operation. See Chapter 9, “Extending Insight”. Once you have added an Analysis PlugIn to Insight, it will be an option in the PlugIns submenu in the Analyze menu.

Using Analyze menu options, you can correlate, fit curves to, perform image processing on, and smooth data. Analyze dialogs give you options for:

- selecting input data, algorithms, and models

- specifying various analysis criteria
- naming output data
- viewing analysis results, if applicable:
  - as new visualizations in the Visualization window.
  - as visualization elements inserted into existing visualizations.
  - as a summary dialog.

Correlation

Select “Correlate” to open a dialog which allows you to correlate data. The dialog options displayed depend on the algorithm selected. When you select an algorithm from the dialog’s Algorithm droplist, the unique options associated with that algorithm appear. For more details, see “Correlation Analysis” in Chapter 15 of *Using IDL*.

What is Correlation?

Correlation involves quantifying the “likeness” or “degree to fit” of one or more sample populations to an ideal linear model or to other sample populations. The measure of likeness may be based upon the actual data values or upon their magnitude-based ranks. Based on criteria you specify in the Correlate dialog, Insight automatically computes the correlation and opens a window showing the correlation value. For example, an output value of 1.0 indicates a perfect positive linear correlation; an output value of -1.0 indicates a perfect negative linear correlation; an output value of -0.98 indicates a high negative linear correlation; and an output value close to zero indicates a poor linear correlation.

The Correlate Dialog

When you select the “Correlate” option from the Analyze menu, the Correlate dialog opens. The Correlate dialog allows you to select a correlation algorithm, specify data to correlate, and generate output data. Select a correlation algorithm by selecting a type of correlation from the “Algorithm” droplist. The Correlate dialog is shown in Figure 6-1.

Common Fields in the Correlate Dialog

Different correlation algorithms require different types of input data. As a result, when you select different correlation algorithms from the “Algorithm” droplist, the Correlate dialog displays the appropriate fields.

This section describes the fields in the Correlate dialog that are the same for all versions of the dialog. Fields that are unique to a particular algorithm are described under that algorithm’s heading.

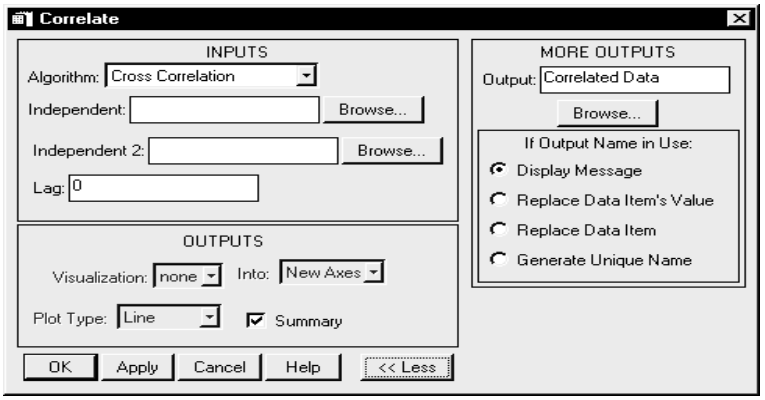


Figure 6-1: The Correlate Dialog with the Cross Correlation algorithm selected

Algorithm Droplist

Choose the type of correlation analysis you wish to perform from the Algorithm droplist.

Independent Text Field and Browse Button

In the “Independent” text field, enter a data name or click “Browse” to open a *Browser*. If you have selected a visualization element in the Visualization window, the name of the data corresponding to that selection automatically appears in this text field. In the Data Browser, you can select one item and click “OK”. The selected data name appears in the text field.

Summary Checkbox

Select the “Summary” checkbox to display a summary of the results of the operation. Summary dialogs are not available when you choose one of the “correlogram” options from the Algorithm droplist.

Visualization Droplist

If you have selected a correlogram from the algorithm droplist, you can choose to create a visualization of your correlation results. From the “Visualization” droplist select one of three ways to visualize the correlation data in the Visualization window:

- none

  Your resulting data will not be visualized in the Visualization window, but if you click "OK" the data will be stored in the project's Data Manager.

- insert

  Insight inserts the visualization element of the resulting data into the visualization selected in the Visualization window. When you click "OK" the data will be stored in the project's Data Manager.

- new

  Insight visualizes your data in the next available space in the window's tiling scheme. When you click "OK" the data will be stored in the project's Data Manager.

Into Droplist
If you have selected a correlogram from the algorithm droplist, use these menu options to select the axes used:

- New Axis

  Use new X and Y axes.

- Other

  Insert plot into the pair of axes listed.

Plot Type Droplist
If you have selected a correlogram from the algorithm droplist, use these menu options to select the type of plot: Line, Scatter, or Histogram.

More >> Button
Click this button to view additional options for performing the analysis.

<< Less Button
(This option appears when you select the dialog's "More >>" button.) Click this button to close the extended section of the dialog that displays additional options for performing the analysis.

Output Text Field and Browse Button
(This option appears when you select the dialog's "More >>" button.) To save the output data generated by this analysis to a name other than the default name listed in the text field, click in the text field and edit or click the "Browse..." button and select a data item.

If Output Name in Use
Choose the appropriate button to determine how duplicate data names will be handled:

- Display Message - Displays a dialog warning message if the Output data name is already in use by another data item.

- Replace Data Item's Value - Replaces the "value" of an existing data item of the same name. This will result in dynamic updating of any current uses of that item, where possible. For example, a visualization would automatically attempt to redraw using the new value.
- Replace Data Item - Replaces the data item, i.e., the old data item will be deleted and a new one will be created. Future use of the old item will no longer be possible. For example, if an old item was being visualized, you would loose the ability to edit its properties.
- Generate Unique Name - Generates a unique (unused) name for the data item.

To Perform the Analysis

After you have finished selecting options in the Correlate dialog, you can perform the operation in either of two ways:

1. Click "Apply" to perform the operation as a trial.

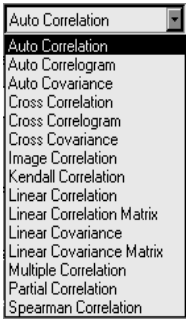
   This option is helpful when you want to "try out" various options before making any permanent data and/or visualization changes. The analysis dialog will remain open so you may modify the parameters and use the Apply option as many times as you wish.

2. Click "OK" to perform the operation, accepting any data and/or visualization changes.

   The analysis dialog will close. Changes cannot be undone via the Undo <Action> button of the Visualization window until the next action that affects that window is performed.

Options for Auto Correlation

Description



Auto Correlation is a method of quantifying the "degree of fit" of an n-element data series (vector) to a linear model (i.e., a line where $y=a+bx$). The resulting value of the analysis is a scalar quantity in the interval [-1.0, 1.0]. Correlation is said to exist as the value nears 1.0. A negative correlation is said to exist as the value nears -1.0. No correlation is said to exist as the value nears 0.0.

Auto Correlation is computed as a function of Lag which can be thought of as the time offset of the data series. Lag is an integer value and must be in the range of [-n, n] where n is the number of elements in the data series. A lag of 0 will produce a standard auto correlation.

Typical Uses

Auto Correlation is often used with Lag to determine the *stationarity* of a time-series. A time-series is defined here as a sequential collection of data observations indexed over time. A stationary series exhibits statistical properties (e.g., correlation) that are unchanged as the period of observation is moved forward or backward in time. This type of analysis is useful in predicting trends and cyclical fluctuations.

Algorithm Droplist

From the Algorithm droplist, select Auto Correlation. Dialog options for this algorithm are displayed. This Correlation cannot be visualized; however, a Summary dialog is available.

Note For more information, see A_CORRELATE in the *IDL Reference Guide* and "Correlation Analysis" in Chapter 15 of *Using IDL*.

Fields Unique to the Auto Correlation Dialog

The following fields are unique to this dialog. See "The Correlate Dialog" on page 105 for a discussion of the fields that are common to all of the correlation dialogs.

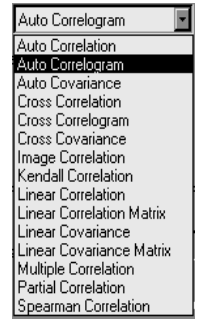
Lag Text Field

In the "Lag" text field, enter the offset as an integer value. The lag represents a time difference between elements in a dataset and indicates how far to look behind or ahead in time.

Options for Auto Correlogram

Description

Auto Correlogram is a plot which displays Auto Correlation on the y-axis versus Lag on the x-axis.



Typical Uses

Use Auto Correlogram to graphically determine the stationarity of a time-series. This may be useful in predicting data trends and fluctuations in time.

Algorithm Droplist

From the Algorithm droplist, select Auto Correlogram. Dialog options for this algorithm are displayed.

Note For more information, see A_CORRELATE in the *IDL Reference Guide* and "Correlation Analysis" in Chapter 15 of *Using IDL*.

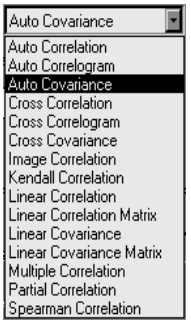
Fields Unique to the Auto Correlogram Dialog

There are no fields unique to the Auto Correlation dialog.

Options for Auto Covariance

Description

Auto Covariance is the same as auto correlation except non-zero mean values of the data are removed before the calculation.



Typical Uses

Advanced statistical analysis.

Algorithm Droplist

From the Algorithm droplist, select Auto Covariance. Dialog options for this algorithm are displayed.

Note For more information, see A_CORRELATE in the *IDL Reference Guide* and "Correlation Analysis" in Chapter 15 of *Using IDL*.

Fields Unique to the Auto Covariance Dialog

The following fields are unique to this dialog. See "The Correlate Dialog" on page 105 for a discussion of the fields that are common to all of the correlation dialogs.

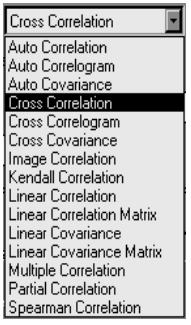
Lag Text Field

In the "Lag" text field, enter the offset as an integer value. The lag represents a time difference between elements in a dataset and indicates how far to look behind or ahead in time.

Options for Cross Correlation

Description

Cross Correlation computes the "degree of fit" to a linear model between two *n*-element data series, X and Y, as a function of lag. Lag is an integer value and must be in the range of [-n, n] where n is the number of elements in the data series. A lag of 0 will produce a standard linear cross correlation. (See Linear Cross Correlation below.)



Typical Uses

Cross Correlation can be used to determine the degree of fit between two data sets X and Y. As with auto correlation, correlation is said to exist between the data sets as the correlation value nears 1.0. A negative correlation is said to exist as the value nears -1.0. No correlation is said to exist as the value nears 0.0.

Algorithm Droplist

From the Algorithm droplist, select Cross Correlation. Dialog options for this algorithm are displayed.

Note For more information, see C_CORRELATE in the *IDL Reference Guide* and "Correlation Analysis" in Chapter 15 of *Using IDL*.

Fields Unique to the Cross Correlation Dialog

The following fields are unique to this dialog. See "The Correlate Dialog" on page 105 for a discussion of the fields that are common to all of the correlation dialogs.

Independent 2 Text Field and Browse Button

In the "Independent 2" text field, enter a data name or click "Browse" to choose a data item from the Data Manager.

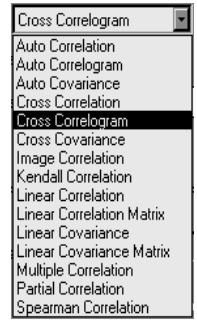
Lag Text Field

In the "Lag" text field, enter the offset as an integer value. The lag represents a time difference between elements in a dataset and indicates how far to look behind or ahead in time.

Options for Cross Correlogram

Description

The Cross Correlogram is a plot which displays Cross Correlation on the y-axis versus Lag on the x-axis. In effect, this is a plot of the cross correlation between the two data sets over time.



Typical Uses

Cross Correlogram can be used to graphically display the stationarity of a time-series consisting of two data sets. This may be useful in predicting data trends and fluctuations in time.

Algorithm Droplist

From the Algorithm droplist, select Cross Correlogram. Dialog options for this algorithm are displayed.

Note For more information, see C_CORRELATE in the *IDL Reference Guide* and "Correlation Analysis" in Chapter 15 of *Using IDL*.

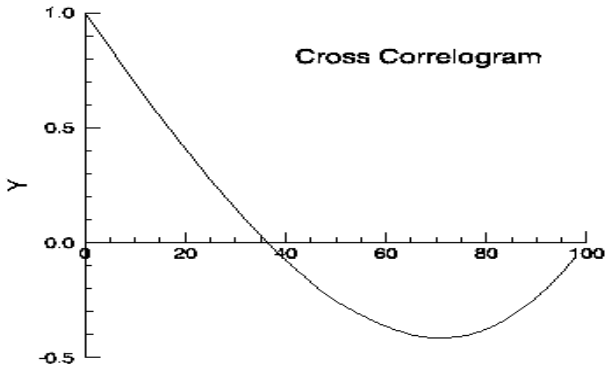


Figure 6-2: Cross Correlogram

Fields Unique to the Cross Correlogram Dialog

The following fields are unique to this dialog. See "The Correlate Dialog" on page 105 for a discussion of the fields that are common to all of the correlation dialogs.

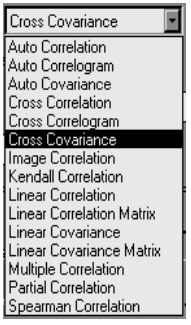
Independent 2 Text Field and Browse Button

In the "Independent 2" text field, enter a data name or click "Browse" to choose a data item from the Data Manager.

Options for Cross Covariance

Description

Cross Covariance is the same as cross correlation except non-zero mean values of the data are removed before the calculation.



Typical Uses

Advanced statistical analysis.

Algorithm Droplist

From the Algorithm droplist, select Cross Covariance. Dialog options for this algorithm are displayed.

Note For more information, see C_CORRELATE in the *IDL Reference Guide* and "Correlation Analysis" in Chapter 15 of *Using IDL*.

Fields Unique to the Cross Covariance Dialog

The following fields are unique to this dialog. See "The Correlate Dialog" on page 105 for a discussion of the fields that are common to all of the correlation dialogs.

Independent 2 Text Field

In the Independent 2 Text Field, enter a data name or click “Browse” to open the Data Browser of data from which to choose.

Lag Text Field

In the “Lag” text field, enter the offset as an integer value. The lag represents a time difference between elements in a dataset and indicates how far to look behind or ahead in time.

Options for Image Correlation

Description

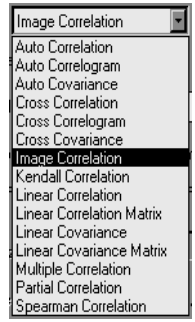


Image Correlation determines the “degree of fit” between two images which are represented by *m x n* element data arrays. The arrays must be 2-dimensional and of the same size in both the m and n dimensions. Correlation is said to exist as the value nears 1.0. No correlation is said to exist as the value nears 0.0. A value of exactly -1.0 means that one image is the negative (photographic) of the other.

Typical Uses

Use Image Correlation to determine the similarity between two images.

Algorithm Droplist

From the Algorithm droplist, select Image Correlation. Dialog options for this algorithm are displayed.

Note For more information, see “Correlation Analysis” in Chapter 15 of *Using IDL*.

Fields Unique to the Image Correlation Dialog

The following fields are unique to this dialog. See “The Correlate Dialog” on page 105 for a discussion of the fields that are common to all of the correlation dialogs.

Independent 2 Text Field

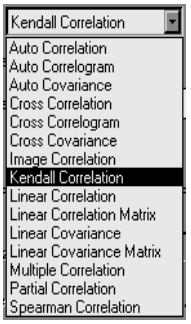
In the Independent 2 Text Field, enter a data name or click “Browse” to open the Data Browser of data from which to choose.

Orientation

In the Orientation Text Field, select an orientation for measuring the similarity of *scan lines:* “By Row” or “By Column”. Usually, this means measuring the similarity of the rows. However, if your selected images are defined “column-wise” select the “By Column” option.

Options for Kendall Correlation

Description



The Kendall Correlation computes Kendall's (*tau*) rank correlation between two data sets, X and Y. The result is two numbers: the rank correlation coefficient (*tau*) and the two-sided significance of its deviation from 0. The significance is a value in the interval [0.0, 1.0]; a smaller value indicates a more significant correlation. (Also see "Options for Spearman Correlation" on page 118.)

Typical Uses

The Kendall Correlation is useful for comparing the correlation between pairs of ranked data (nonparametric correlation). It is similar to the Spearman Correlation but it is important to note that the Kendall and Spearman correlations will give different results. The user should have a good knowledge of statistical methods when using either correlation.

Algorithm Droplist

From the Algorithm droplist, select Kendall Correlation. Dialog options for this algorithm are displayed.

Note For more information, see R_CORRELATE in the *IDL Reference Guide* and "Correlation Analysis" in Chapter 15 of *Using IDL*.

Fields Unique to the Kendall Correlation Dialog

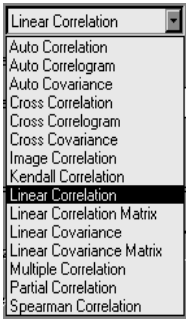
The following fields are unique to this dialog. See "The Correlate Dialog" on page 105 for a discussion of the fields that are common to all of the correlation dialogs.

Independent 2 Text Field

In the Independent 2 Text Field, enter a data name or click "Browse" to open the Data Browser of data from which to choose.

Options for Linear Correlation

Description



Linear Correlation computes the "degree of fit" to a linear model (a line where $y=ax+b$) between two n-element data series, X and Y. Linear Correlation is the same as Cross Correlation with Lag set to 0.

Typical Uses

Linear Correlation is a standard statistical analysis used to determine the degree of fit between two data series.

Algorithm Droplist

From the Algorithm droplist, select Linear Correlation. Dialog options for this algorithm are displayed.

Note For more information, see CORRELATE in the *IDL Reference Guide* and "Correlation Analysis" in Chapter 15 of *Using IDL*.

Fields Unique to the Linear Correlation Dialog

The following fields are unique to this dialog. See "The Correlate Dialog" on page 105 for a discussion of the fields that are common to all of the correlation dialogs.

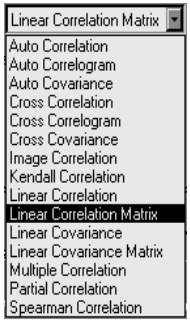
Independent 2 Text Field

In the Independent 2 Text Field, enter a data name or click "Browse" to open the Data Browser of data from which to choose.

Options for Linear Correlation Matrix

Description

The Linear Correlation Matrix computes the correlation between the vectors of a two-dimensional, *m x n* array. If vectors of unequal length are specified, the longer vector is truncated to the size of the smaller vector. The result is an *m x m* correlation matrix (assuming *m* is the dimension of the smaller vector) of linear correlation coefficients.



Typical Uses

Use the linear correlation matrix to calculate the correlation at each index of two vectors in an array.

Algorithm Droplist

From the Algorithm droplist, select Linear Correlation Matrix. Dialog options for this algorithm are displayed.

Note For more information, see CORRELATE in the *IDL Reference Guide* and "Correlation Analysis" in Chapter 15 of *Using IDL*.

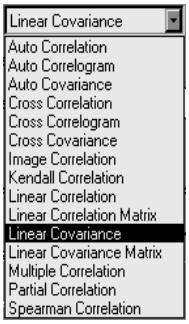
Fields Unique to the Linear Correlation Matrix Dialog

There are no fields unique to this dialog.

Options for Linear Covariance

Description

Linear Covariance is a method of determining the covariance between two data sets (vectors). The data sets must have the same number of elements.



Typical Uses

Advanced statistical analysis.

Algorithm Droplist

From the Algorithm droplist, select Linear Covariance. Dialog options for this algorithm are displayed.

Note For more information, see CORRELATE in the *IDL Reference Guide* and "Correlation Analysis" in Chapter 15 of *Using IDL*.

Fields Unique to the Linear Covariance Dialog

The following fields are unique to this dialog. See "The Correlate Dialog" on page 105 for a discussion of the fields that are common to all of the correlation dialogs.

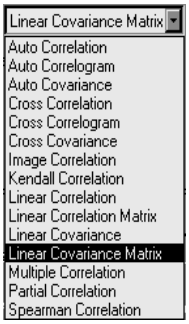
Independent 2 Text Field

In the Independent 2 Text Field, enter a data name or click "Browse" to open the Data Browser of data from which to choose.

Options for Linear Covariance Matrix

Description

The Linear Covariance Matrix computes the covariance between the vectors of a two-dimensional, *m x n* array. If vectors of unequal length are specified, the longer vector is truncated to the size of the smaller vector. The result is an *m x m* covariance matrix (assuming *m* is the dimension of the smaller vector) of linear covariance coefficients.



Typical Uses

Use the Linear Covariance Matrix to calculate the covariance at each index of two vectors in an array.

Algorithm Droplist

From the Algorithm droplist, select Linear Covariance Matrix. Dialog options for this algorithm are displayed.

Note For more information, see CORRELATE in the *IDL Reference Guide* and "Correlation Analysis" in Chapter 15 of *Using IDL*.

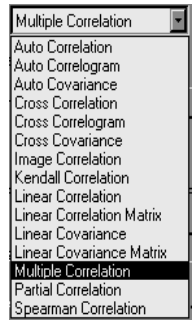
Fields Unique to the Linear Covariance Matrix Dialog

There are no fields unique to this dialog.

Options for Multiple Correlation

Description

Multiple Correlation will calculate the correlation between the dependent variable X, an array of *m* columns and *n* rows, and an independent *n*-element vector, Y. Y must be the same size as the row dimension (*n*) of the array, X.



Typical Uses

Multiple Correlation is useful for calculating the correlation between multiple data sets (e.g., an array or its elements and a data series.)

Algorithm Droplist

From the Algorithm droplist, select Multiple Correlation. Dialog options for this algorithm are displayed.

Note For more information, see M_CORRELATE in the *IDL Reference Guide* and "Correlation Analysis" in Chapter 15 of *Using IDL*.

Fields Unique to the Multiple Correlation Dialog

The following fields are unique to this dialog. See "The Correlate Dialog" on page 105 for a discussion of the fields that are common to all of the correlation dialogs.

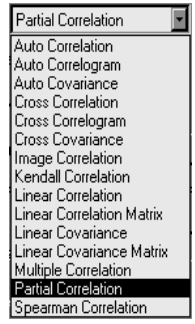
Dependent Text Field and Browse Button

In the "Dependent" text field, enter a data name or click "Browse" to select a data item from the Data Manager.

Options for Partial Correlation

Description

Partial Correlation computes the partial correlation coefficient of two *n*-element data series (dependent variable X and independent variable Y) when the effects of a third variable C are removed.



Typical Uses

Advanced statistical analysis.

Algorithm Droplist

From the Algorithm droplist, select Partial Correlation. Dialog options for this algorithm are displayed.

Note For more information, see P_CORRELATE in the *IDL Reference Guide* and "Correlation Analysis" in Chapter 15 of *Using IDL*.

Fields Unique to the Partial Correlation Dialog

The following fields are unique to this dialog. See "The Correlate Dialog" on page 105 for a discussion of the fields that are common to all of the correlation dialogs.

Dependent Text Field and Browse Button

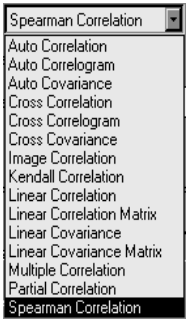
In the “Dependent” text field, enter a data name or click “Browse” to select a data item from the Data Manager.

To Remove Text Field and Browse Button

The “To Remove” option allows you to remove a variable from an analysis if you want to see partial data. In the “To Remove” Text Field enter a data name or click “Browse” to select a data item from the Data Manager.

Options for Spearman Correlation

Description



The Spearman Correlation computes Spearman’s (*rho* or r_s) rank correlation between two data sets, X and Y. The result is two numbers: the rank correlation coefficient (r_s) and the two-sided significance of its deviation from 0. The significance is a value in the interval [0.0, 1.0]; a smaller value indicates a more significant correlation. (Also see“Options for Kendall Correlation” on page 114.)

Typical Uses

The Spearman Correlation is useful for comparing the correlation between pairs of ranked data (nonparametric correlation). It is similar to the Kendall Correlation but it is important to note that the Kendall and Spearman correlations will give different results. The user should have a good knowledge of statistical methods when using either correlation.

Algorithm Droplist

From the Algorithm droplist, select Spearman Correlation. Dialog options for this algorithm are displayed.

Note For more information, see R_CORRELATE in the *IDL Reference Guide* and “Correlation Analysis” in Chapter 15 of *Using IDL*.

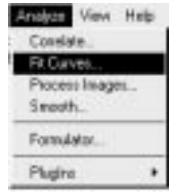
Fields Unique to the Spearman Correlation Dialog

The following fields are unique to this dialog. See “The Correlate Dialog” on page 105 for a discussion of the fields that are common to all of the correlation dialogs.

Independent 2 Text Field

In the Independent 2 Text Field, enter a data name or click “Browse” to select a data item from the Data Manager.

Curve Fitting



Select the "Fit Curves" option to open a dialog which allows you to fit a curve to data. The dialog options displayed depend on the model selected. When you select a model from the dialog's "Model" droplist, the unique options associated with that model appear. For more details, see "Curve and Surface Fitting" in Chapter 15 of *Using IDL*.

What is Curve Fitting?

With curve fitting, you can find an analytic representation (equation, or *Model*) which represents data more compactly. Basically, this involves fitting your data to a specific type of curve. If you visualize your data and select the curve or visualization before bringing up the curve-fitting dialog, you will be able to insert the resulting curve fit into the existing plot.

Using Insight's Fit Curves dialog, you can scroll through a list of models to find the best representation of your data. As you select each model name, its mathematical formula as well as a representative graph are displayed on the right-hand side of the dialog. After specifying all dialog information, you may visualize the curve fitting in the Visualization window and view results in a Fit Curve Summary dialog.

Curve Fitting Basics

Curve fitting using Insight is a simple way of determining an equation for your data set. A data set is a series of data points which can be plotted on the x and y axes. Perhaps the

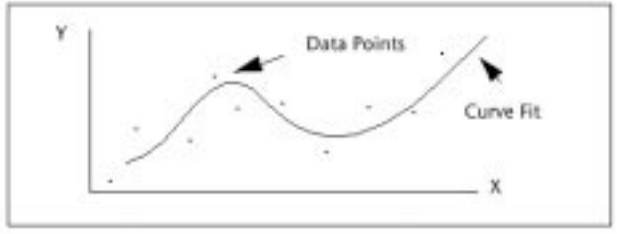


Figure 6-3: Curve-Fitting Data Poi

most familiar types of curve-fitting equations are polynomials of the form $y=A+Bx+Cx^2+...+Zx^m$. The simplest form of the polynomial equation is $y=A$, which is

the plot of a constant value of y. The linear form of the polynomial equation is $y=A+Bx$, where the parameter B is the slope of the line and A is its y-intercept.

Figure 6-4: Simple Polynomials

By adding an x-squared term, we now have the quadratic form of the polynomial equation, $y=A+Bx+Cx^2$. The quadratic equation has a curvature and is called 2nd order due to the x-squared term. In general, a polynomial equation that describes a curve must have at least one x term raised to a power of 2 or more. Other curve-fitting polynomial equations include cubic, quartic, and quintic (x^3, x^4, and x^5, respectively).

In addition to polynomials, Insight has other curve-fitting equations that describe curves of different types and which may be more applicable to your data than the simple polynomials. These equations include, among others, hyperbolic, exponential, trigonometric, log, and Gaussian.

Matching Data to the Curve Fitting Equation

As a general rule, data should be fitted to a curve that has the *characteristics* of the data. For example, if a plot of the data seems to indicate a straight line, then linear curve fitting would be appropriate. If a plot of the data shows higher-order characteristics (i.e., x^2, x^3, x^4, or x^5 terms), you can try quadratic, cubic, quartic, or quintic curve fitting. If the data has exponential, trigonometric, Gaussian and/or other characteristics, you can try the appropriate model.

Chi-Square error and Relative Maximum Deviation

Along with the equation parameters (*A,B,C, etc.*), the curve-fitting analysis will return two numbers: the *Chi-Square error* and *Relative Maximum Deviation*. The Chi-Square error is a statistical measurement of the error between the actual data points and the data

points calculated using the equation. The Relative Maximum Deviation is a measurement of the largest deviation of the data from the equation.

Figure 6-5: Example of Curve-f
Results: Parameters A and B, Chi
Error, Relative Maximum Deviat

The best way to determine how well a model fits the data is to first check the Chi-Square Error. The smaller the Chi-Square Error (i.e., the closer it is to zero), the better the fit of the selected model to the data. You should also pay attention to the Relative Maximum Deviation. A Chi-Square Error very close to zero and a Relative Maximum Deviation close to one could indicate that there may be one or more bad samples (data collection artifact). You may wish to experiment with different curve-fitting methods until you find the one that minimizes both numbers.

The Fit Curves Dialog

When you select the “Fit Curves” option from the Analyze menu, the Fit Curves dialog opens. The Fit Curves dialog allows you to select a model to fit, specify data to fit to the model, and generate output data. Select a curve-fitting model by selecting a type of fit from the “Model” droplist. The Fit Curves dialog is shown in Figure 6-6.

Fields in the Fit Curves Dialog

The following fields are included in the Fit Curves dialog:

Model Droplist

The Model droplist allows you to select the type of equation to attempt to fit your data to.

Model Display

The Model Display area displays the name, formula, and an example of the type of curve selected in the “Model” droplist.

Previous Button

Click this button to display the model name listed previous to the model name displayed in the “Model” droplist.

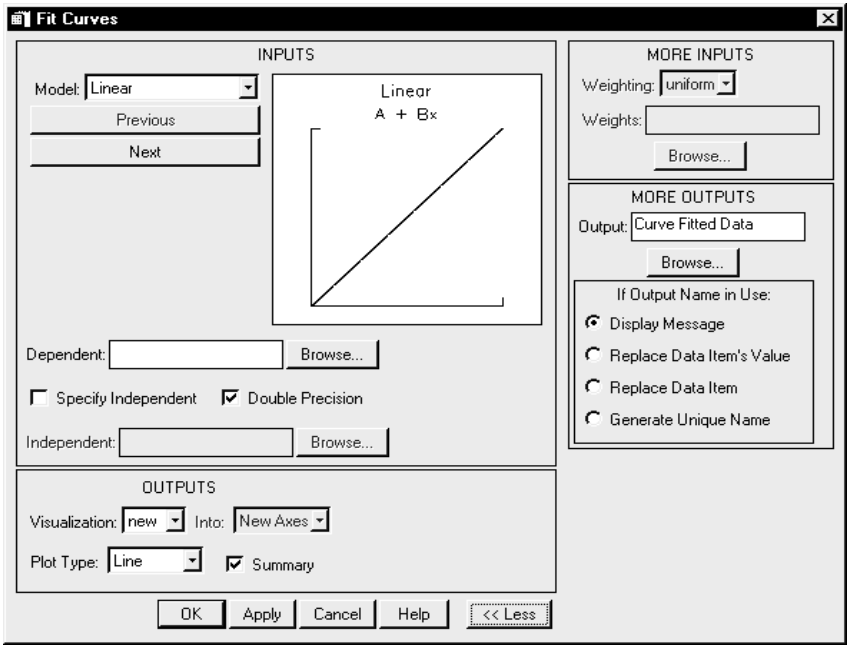


Figure 6-6: The Fit Curves Dialog

Next Button

Click this button to display the model name listed after the model name displayed in the "Model" droplist.

Dependent Text Field and Browse Button

In the "Dependent" text field, enter a data name or click "Browse" to select a data item from the Data Browser.

Specify Independent Checkbox

Select this option to include an independent data item in your analysis.

Double Precision Checkbox

Select this option to use double-precision, floating-point arithmetic.

Independent Text Field and Browse Button

First select the "Independent" Checkbox. Then, in the "Independent" text field, enter a data name or click "Browse" to select a data item from the Data Browser. The number of elements of the "Independent" data must be the same as the number of elements of the "Dependent" data.

Visualization Droplist

From the "Visualization" droplist, select one of three ways to visualize the fitted data in the Visualization window:

- none

  Your resulting data will not be visualized in the Visualization window, but if you click "OK" the data will be stored and listed as an item in the Data Manager.

- insert

  Insight inserts the visualization element of the resulting data into the visualization selected in the Visualization window. When you click "OK" the data will be stored in the project's Data Manager.

- new

  Insight visualizes your data in the next available space in the window's tiling scheme. When you click "OK" the data will be stored in the project's Data Manager.

Into Droplist

Use these menu options to select the axes used:

- New Axis

  Use new X and Y axes.

- Other

  Insert plot into the pair of axes listed.

Plot Type Droplist

Use these menu options to select the type of plot: Line, Scatter, or Histogram.

Summary Checkbox

Selecting this option opens a Summary dialog which displays results immediately after Insight has completed your analysis operation. Information displayed in the Summary dialog includes:

The *Model* selected in the dialog.

The *Equation* for the model selected.

The *Parameters* Insight computes for the selected model and data.

The *Chi-Square Error* which indicates how well the selected model fits the data. The smaller the Chi-Square Error (i.e., the closer it is to zero), the better the fit of the selected model to the data.

The *Relative Maximum Deviation* which represents the maximum point at which the model differs from data. If the individual points that make up the data fit the model with

a high degree of accuracy, the Relative Maximum Deviation is close to zero. A Relative Maximum Deviation value closer to one indicates that there may be a hidden or "bad" value in the data.

More >> Button

Click this button to view additional options for performing the analysis.

<< Less Button

(This option appears when you select the dialog's "More >>" button.) Click this button to close the extended section of the dialog that displays additional options for performing the analysis. The dialog displaying the basic dialog options remains open.

Weighting Droplist

(This option appears when you select the dialog's "More >>" button.) From the droplist, select "uniform", "inverse" or "vector" weighting. Weighting gives greater or lesser importance to the magnitude of Y elements. This involves assigning a numerical coefficient to a Y element to express its relative importance in a frequency distribution.

- With uniform weighting, all Y values have the same relative importance.
- With Inverse weighting, the larger the magnitude of a Y value, the lesser its importance, and the smaller the magnitude of a Y value the greater its importance.
- With Vector weighting, you must specify a data item representing the weights. This requires user knowledge of the selected X and Y elements.

The concept of weighting does not apply to all curve-fitting models. When a model for which weighting is not an option is selected, the Weighting droplist is unavailable.

Weights Text Field and Browse Button

(This option appears when you select the dialog's "More >>" button.) The Weights text field is available when the Vector option has been selected from the "Weighting" droplist.

In the text field, enter a data name or click "Browse" to select a data item from the Data Manager.

Output Text Field and Browse Button

(This option appears when you select the dialog's "More >>" button.) To save the output data generated by this analysis to a name other than the default name listed in the text field, click in the text field and edit or click the "Browse..." button and select a data item.

If Output Name in Use

Choose the appropriate button to determine how duplicate data names will be handled:

- Display Message - Displays a dialog warning message if the Output data name is already in use by another data item.
- Replace Data Item's Value - Replaces the "value" of an existing data item of the same name. This will result in dynamic updating of any current uses of that item, where possible. For example, a visualization would automatically attempt to redraw using the new value.

- Replace Data Item - Replaces the data item, i.e., the old data item will be deleted and a new one will be created. Future use of the old item will no longer be possible. For example, if an old item was being visualized, you would loose the ability to edit its properties.
- Generate Unique Name - Generates a unique (unused) name for the data item.

To Perform the Analysis

After you have finished selecting options in the Fit Curves dialog, you can perform the operation in either of two ways:

1. Click “Apply” to perform the operation as a trial.

   This option is helpful when you want to “try out” various options before making any permanent data and/or visualization changes. The analysis dialog will remain open so you may modify the parameters and use the Apply option as many times as you wish.

2. Click “OK” to perform the operation, accepting any data and/or visualization changes.

   The analysis dialog will close. Changes via the Undo <Action> button of the Visualization window until the next action that affects that window is performed.

About the Curve-Fitting Models

For general information about curve fitting, see “Curve and Surface Fitting” in Chapter 15 of Using IDL. In addition,

- for information on the linear model, see LINFIT in the *IDL Reference Guide*.
- for information on linear with outliers model, see LADFIT in the *IDL Reference Guide*.
- for information on quadratic, cubic, quartic, quintic, exponential, logsquare, hyperbolic, hyperbolic trig, logistic, geometric, trigonometric summation, and trigonometric product models, see CURVEFIT in the *IDL Reference Guide*.
- for information on quadratic plus Gaussian model, see GAUSSFIT in the *IDL Reference Guide*.
- for information on the variable sinc model, see CURVEFIT in the *IDL Reference Guide*.

Note When Insight uses CURVEFIT, it supplies an *initial guess* vector consisting of all 1.0s.

Note If your data does not start at X=0 and have an integer increment between samples, you should specify an independent vector. This will ensure that the model is applied properly and that inserted visualizations align correctly with existing visualizations.

Curve-Fitting Equations

The following table contains a summary of the curve-fitting equations used by Insight. Listed below the table is a brief description of each equation with its typical uses.

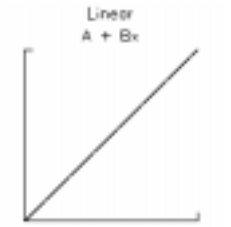
Model	Equation
Linear	$y = A+Bx$
Linear with Outliers	$y = A+Bx$
Quadratic	$y = A+Bx+Cx^2$
Cubic	$y = A+Bx+Cx^2+Dx^3$
Quartic	$y = A+Bx+Cx^2+Dx^3+Ex^4$
Quintic	$y = A+Bx+Cx^2+Dx^3+Ex^4+Fx^5$
Exponential	$y = A+BC^x$
Logsquare	$y = A+Blog(x)+Clog(x^2)$
Hyperbolic	$y = 1/(A+Bx)$
Hyperbolic Trigonometric	$y = A+Bsinh(Cx)+Dcosh(Ex)$
Logistic	$y = 1/(A+BC^x)$
Geometric	$y = A+Bx^C$
Trigonometric Summation	$y = A+Bsin(Cx)+Dcos(Ex)$
Trigonometric Product	$y = A+Bsin(Cx)cos(Dx)$
Quadratic + Gaussian	$y = A+Bx+Cx^2+De^{-(z\wedge 2)/2}$ where $z=(x-E)/F$
Variable Sinc	$y = A+sin(Bx)/Cx$

Table 6-1: Insight Curve-Fitting Equations

Linear: y = A+Bx

Description

A Linear curve fit is of the type $y = A+Bx$. The data set must be an n-element series of numbers (vector). The calculation of the parameters A and B is performed by minimizing the Chi-square error statistic.

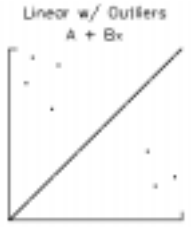


Typical Uses

Linear curve fitting is particularly useful in determining a simple equation to describe a data series which shows no higher-order components (i.e., curvatures). For more information, see LINFIT in the *IDL Reference Guide*.

Linear with Outliers: y = A+Bx

Description



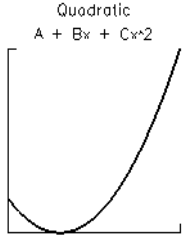
A Linear with Outliers curve fit is the same as a linear curve fit except it reduces the effects of outlying data points (i.e., data that lies outside the normal data range). The parameters A and B are calculated.

Typical Uses

Linear with Outliers curve fitting is an excellent method of removing artifact and other errant data points from an otherwise normal data set. The resulting equation will *not* include the outlying data points in the calculation of the parameters. For more information, see LADFIT in the *IDL Reference Guide*.

Quadratic: $y = A+Bx+Cx^2$

Description



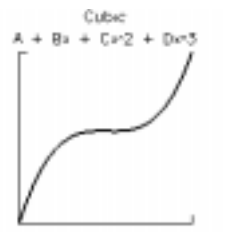
A Quadratic curve fit attempts to fit an *n*-element data series (vector) to the quadratic equation using a gradient-expansion algorithm to compute a non-linear least squares fit; the parameters A, B, and C are calculated.

Typical Uses

Quadratic curve fitting may be useful if your data set has 2nd-order characteristics. For more information, see CURVEFIT in the *IDL Reference Guide*.

Cubic: $y = A+Bx+Cx^2+Dx^3$

Description



A Cubic curve fit attempts to fit an *n*-element data series (vector) to the cubic equation using a gradient-expansion algorithm to compute a non-linear least squares fit; the parameters A, B, C, and D are calculated.

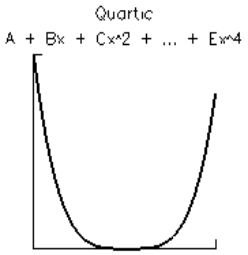
Typical Uses

Cubic curve fitting may be useful if your data set shows 3rd-order characteristics. For more information, see CURVEFIT in the *IDL Reference Guide*.

Quartic: $y = A+Bx+Cx^2+Dx^3+Ex^4$

Description

A Quartic curve fit attempts to fit an *n*-element data series (vector) to the quartic equation using a gradient-expansion algorithm to compute a non-linear least squares fit; the parameters A, B, C, D, and E are calculated.



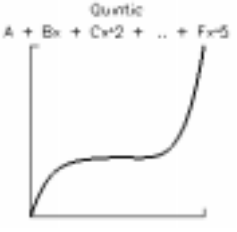
Typical Uses:

Quartic curve fitting may be useful if your data set shows 4th-order characteristics. For more information, see CURVEFIT in the *IDL Reference Guide*.

Quintic: $y = A+Bx+Cx^2+Dx^3+Ex^4+Fx^5$

Description

A Quintic curve fit attempts to fit an *n*-element data series (vector) to the quintic equation using a gradient-expansion algorithm to compute a non-linear least squares fit; the parameters A,B, C, D, E, and F are calculated.



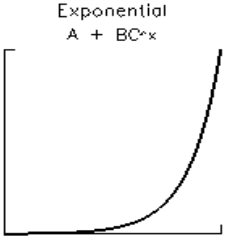
Typical Uses

Quintic curve fitting may be useful if your data set shows 5th-order characteristics. For more information, see CURVEFIT in the *IDL Reference Guide*.

Exponential: $y = A+B^xC$

Description

An Exponential curve fit attempts to fit an *n*-element data series (vector) to the exponential equation using a gradient-expansion algorithm to compute a non-linear least squares fit; the parameters A, B, and C are calculated.



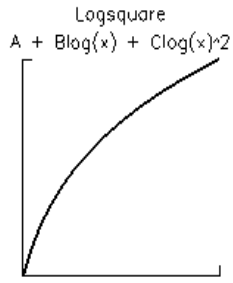
Typical Uses

Use exponential curve fitting when your data has the characteristics of an exponential curve. For more information, see CURVEFIT in the *IDL Reference Guide*.

Logsquare: `y = A+Blog(x)+Clog(x^2)`

Description

A Logsquare curve fit attempts to fit an *n*-element data series (vector) to the logsquare equation using a gradient-expansion algorithm to compute a non-linear least squares fit; the parameters A, B, and C are calculated.



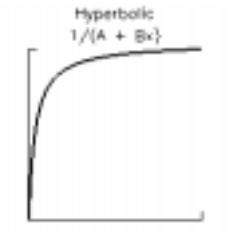
Typical Uses

Use logsquare curve fitting when your data has the characteristics of a logsquare function. For more information, see CURVEFIT in the *IDL Reference Guide*.

Hyperbolic: `y = 1/(A+Bx)`

Description

A Hyperbolic curve fit attempts to fit an *n*-element data series (vector) to the hyperbolic equation using a gradient-expansion algorithm to compute a non-linear least squares fit; the parameters A and B are calculated.



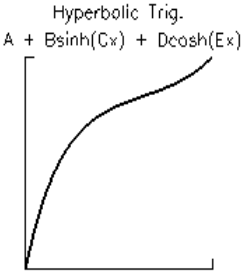
Typical Uses

Use hyperbolic curve fitting when your data has the characteristics of a hyperbolic curve. For more information, see CURVEFIT in the *IDL Reference Guide*.

Hyperbolic Trigonometric: `y = A+Bsinh(Cx)+Dcosh(Ex)`

Description

A Hyperbolic Trigonometric curve fit attempts to fit an *n*-element data series (vector) to the hyperbolic trigonometric equation using a gradient-expansion algorithm to compute a non-linear least squares fit; the parameters A, B, C, D, and E are calculated.



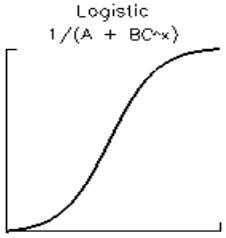
Typical Uses

Use hyperbolic trigonometric curve fitting when your data has the characteristics of hyperbolic trigonometric curves. For more information, see CURVEFIT in the *IDL Reference Guide*.

Logistic: $y = 1/(A+BC^{x})$

Description

A Logistic curve fit attempts to fit an *n*-element data series (vector) to the logistic equation using a gradient-expansion algorithm to compute a non-linear least squares fit; the parameters A, B, and C are calculated.



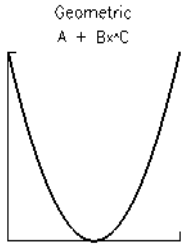
Typical Uses

Use logistic curve fitting when your data has the characteristics of a logistic curve. For more information, see CURVEFIT in the *IDL Reference Guide*.

Geometric: $y = A+Bx^{C}$

Description

A Geometric curve fit attempts to fit an *n*-element data series (vector) to the geometric equation using a gradient-expansion algorithm to compute a non-linear least squares fit; the parameters A, B, and C are calculated.



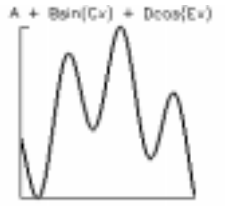
Typical Uses

Use geometric curve fitting when your data has the characteristics of a geometric curve. For more information, see CURVEFIT in the *IDL Reference Guide*.

Trigonometric Summation: `y = A+Bsin(Cx)+Dcos(Ex)`

Description

A Trigonometric Summation curve fit attempts to fit an *n*-element data series (vector) to the trigonometric summation equation using a gradient-expansion algorithm to compute a non-linear least squares fit; the parameters A, B, C, D, and E are calculated.

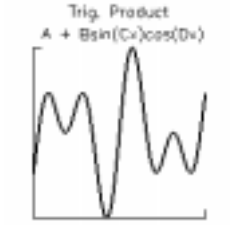


Typical Uses

Use trigonometric summation curve fitting when your data has the characteristics of a trigonometric summation curve. For more information, see CURVEFIT in the *IDL Reference Guide*.

Trigonometric Product: `y = A+Bsin(Cx)cos(Dx)`

Description



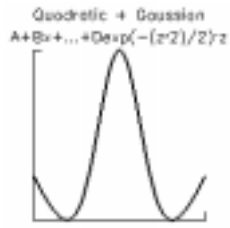
A Trigonometric Product curve fit attempts to fit an *n*-element data series (vector) to the trigonometric product equation using a gradient-expansion algorithm to compute a non-linear least squares fit; the parameters A, B, C, D, and E are calculated.

Typical Uses

Use trigonometric product curve fitting when your data has the characteristics of a trigonometric product curve. For more information, see CURVEFIT in the *IDL Reference Guide*.

Quadratic+Gaussian: `y = A+Bx+Cx2+De-(z2)/2` where *z=(x-E)/F*

Description



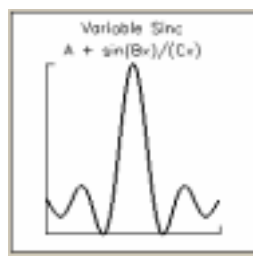
A Quadratic+Gaussian curve fit attempts to fit an *n*-element data series (vector) to the quadratic+gaussian equation using a non-linear least-squares fit algorithm; the parameters A, B, C, D, E, and F are calculated.

Typical Uses

Use the Quadratic+Gaussian curve fit when your data has the characteristics of a quadratic+Gaussian curve. For information, see GAUSSFIT in the *IDL Reference Guide*.

Variable Sinc: `y = A+sin(Bx)/Cx`

Description



A Variable Sinc curve fit attempts to fit an *n*-element data series (vector) to the variable sinc equation using a non-linear least-squares fit algorithm; the parameters A, B, and C are calculated.

Typical Uses

Use the Variable Sinc curve fit when your data has the characteristics of the variable sinc curve. For information, see CURVEFIT in the *IDL Reference Guide*.

Image Processing

Select “Process Images” to open a dialog which allows you to process images. The dialog options displayed depend on the algorithm selected. When you select an algorithm from the dialog’s Algorithm droplist, the unique options associated with that algorithm appear. For more details, see “Image Display Routines” in Chapter 13 of *Using IDL*.

What is Image Processing?

Image processing uses various methods to filter and transform image data. An image consists of a two-dimensional array of pixels. (Insight does not currently support image processing options for true-color images.) The value of each pixel represents the intensity and/or color of that position in the scene. Images of this form are known as sampled or raster images because they consist of a discrete grid of samples. Such images come from many sources and are a common form of representing scientific and medical data.

Filters

A filter (or image processing algorithm) is simply a way of looking for specific information contained in an image. A good example of a filter in everyday life is tinted lenses or sunglasses. Different types of lenses “filter” light in different ways.

Insight currently incorporates several filters for image processing: Lee, Roberts Edge Enhance, Thin, and Sobel. In addition to these filters, tools such as image color enhancement (color tables), image rotation, and frequency domain analysis are available to the user. Note that some of these tools (e.g., Fourier and Wavelet Transforms) require an advanced knowledge of image processing.

The Process Image Dialog

When you select the “Process Images” option from the Analyze menu, the Process Images dialog opens. The Process Images dialog allows you to select an image processing algorithm, specify an image to display and process, and generate output data. Select an image processing algorithm by selecting from the “Algorithm” droplist. The Process Images dialog is shown in Figure 6-7.

Common Fields in the Process Image Dialog

Different image processing algorithms require different types of input data. As a result, when you select different algorithms from the “Algorithm” droplist, the Process Images dialog displays the appropriate fields.

This section describes the fields in the Process Images dialog that are the same for all versions of the dialog. Fields that are unique to a particular algorithm are described under that algorithm’s heading.

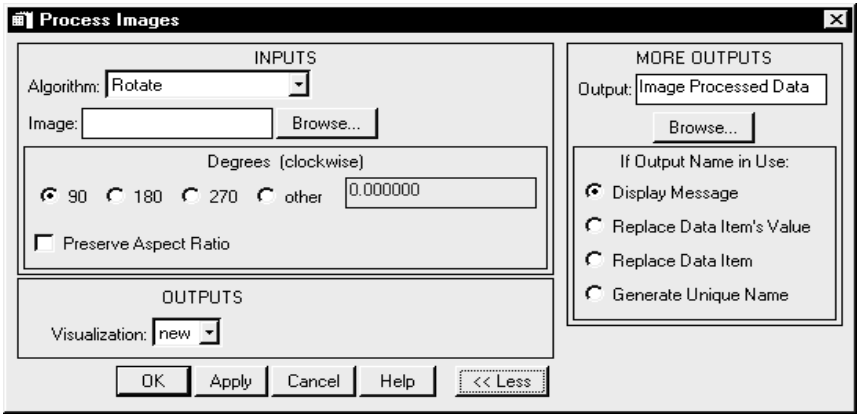


Figure 6-7: The Process Images Dialog

Algorithm Droplist

Choose the type of image processing you wish to perform from the Algorithm droplist.

Image Text Field and Browse Button

In the "Image" text field, enter a data name or click "Browse" to select an image from the Data Browser. Select one item and click "OK". The data name appears in the text field.

Visualization Droplist

From the "Visualization" droplist, select one of two options:

- none

  Your resulting data will not be visualized in the Visualization window, but if you click "OK" the data will be stored in the project.

- new

  Insight visualizes your data in the next available space in the Visualization window's tiling scheme. When you click "OK" the data will be stored in the project and listed in the Data Manager window.

More >> Button

Click this button to view additional options.

Output Text Field and Browse Button

(This option appears when you select the dialog's "More >>" button.) To save the output data generated by this analysis to a name other than the default name listed in the text field, click in the text field and edit or click the "Browse..." button and select a data item.

<< Less Button

(This option appears when you select the dialog's "More >>" button.) Click this button to close the extended section of the dialog that displays additional options for performing the analysis. The dialog displaying the basic dialog options remains open.

If Output Name in Use

Choose the appropriate button to determine how duplicate data names will be handled:

- Display Message - Displays a dialog warning message if the Output data name is already in use by another data item.
- Replace Data Item's Value - Replaces the "value" of an existing data item of the same name. This will result in dynamic updating of any current uses of that item, where possible. For example, a visualization would automatically attempt to redraw using the new value.
- Replace Data Item - Replaces the data item, i.e., the old data item will be deleted and a new one will be created. Future use of the old item will no longer be possible. For example, if an old item was being visualized, you would loose the ability to edit its properties.
- Generate Unique Name - Generates a unique (unused) name for the data item.

To Perform the Analysis

After you have finished selecting options in the Process Images dialog, you can perform the operation in either of two ways:

1. Click "Apply" to perform the operation as a trial.

   This option is helpful when you want to "try out" various options before making any permanent data and/or visualization changes. The analysis dialog will remain open so you may modify the parameters and use the Apply option as many times as you wish.

2. Click "OK" to perform the operation, accepting any data and/or visualization changes.

   The analysis dialog will close. Changes via the Undo <Action> button of the Visualization window until the next action that affects that window is performed.

Options for Density Function

Description

The Density Function compares two images and returns a histogram (distribution) equal to the number of simultaneous occurrences at the specified array element. The images must have the same dimensions.

Typical Uses

The Density Function is useful in determining the similarity between two images.

Algorithm Droplist

From the droplist, select Density Function. Dialog options for this algorithm are displayed.

Note For more information, see HIST_2D in the *IDL Reference Guide* and "Image Display Routines" in Chapter 13 of *Using IDL*.

Fields Unique to the Density Function Dialog

The following fields are unique to this dialog. See "The Process Image Dialog" on page 132 for a discussion of the fields that are common to all of the image processing dialogs.

Image 2 Text Field and Browse Button

In the "Image" text field, enter a data name or click "Browse" to open the Data Browser of data from which to choose. In the Data Browser, you can select one item and click "OK". The selected data name appears in the text field.

Options for Dilate

Description

The dilate algorithm, commonly known as "fill", "expand" or "grow", is used to fill holes and other types of data loss in an image which are smaller than the structuring element. The structuring element is an array which is moved over each pixel of the image; the structuring element must have the same *number* of dimensions as the image. The user creates the structuring element.

Note The structuring element must contain boolean values (0's and 1's) and have the same *number* of dimensions as the image array. For example, the structuring element might be a 2x3 array while the image might be a 100x100 array. The number of dimensions (2) is the same for both while the actual dimension sizes are different.

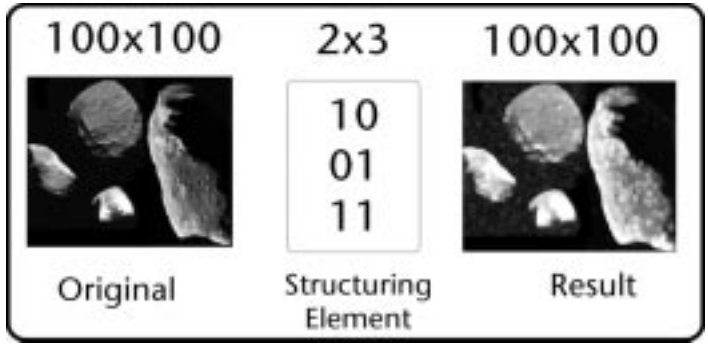


Figure 6-8: Dilate Structuring Element (ast

Typical Uses

Dilate is useful in filling holes, islands, and peninsulae which are smaller than the user-specified structuring element. It can also be used to produce image effects. Dilate can be considered the inverse or dual of erode, however one function cannot be used to reverse the effects of the other.

Algorithm Droplist

From the droplist, select Dilate. Dialog options for this algorithm are displayed.

Note For more information, see DILATE in the *IDL Reference Guide* and "Image Display Routines" in Chapter 13 of *Using IDL*.

Fields Unique to the Dilate Dialog

The following fields are unique to this dialog. See "The Process Image Dialog" on page 132 for a discussion of the fields that are common to all of the image processing dialogs.

Structure Text Field and Browse Button

In the "Structure" text field, enter a data name or click "Browse" to select a structuring element from the Data Manager. In the Data Browser, you can select one item and click "OK". The selected data name appears in the text field.

Options for Erode

Description

The erode algorithm, commonly known as "shrink" or "reduce", is used to remove islands of pixels smaller than the structuring element. The structuring element is an array which is moved over each pixel of the image; the structuring element must have the same *number* of dimensions as the image. The user creates the structuring element.

Note The structuring element must contain boolean values (0's and 1's) and have the same *number* of dimensions as the image array. For example, the structuring element might be a 2x3

array while the image might be a 100x100 array. The number of dimensions (2) is the same for both while the actual dimension sizes are different.

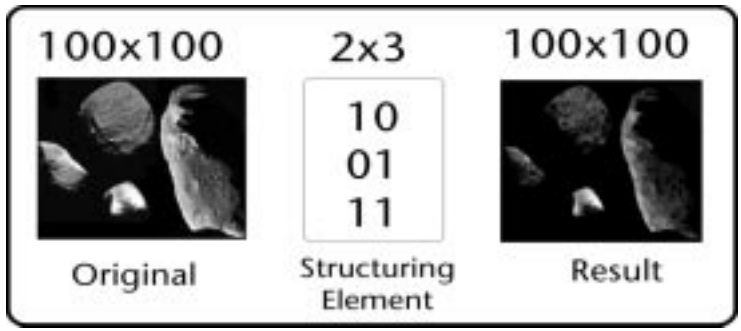


Figure 6-9: Erode Structuring Element (aster

Typical Uses

Use erode to remove islands of pixels smaller than the user-specified structuring element. It can also be used to produce image effects. Erode can be considered the inverse or dual of dilate, however one function cannot be used to reverse the effects of the other.

Algorithm Droplist

From the droplist, select Erode. Dialog options for this algorithm are displayed.

Note For more information, see ERODE in the *IDL Reference Guide* and "Image Display Routines" in Chapter 13 of *Using IDL*.

Fields Unique to the Erode Dialog

The following fields are unique to this dialog. See "The Process Image Dialog" on page 132 for a discussion of the fields that are common to all of the image processing dialogs.

Structure Text Field and Browse Button

In the "Structure" text field, enter a data name or click "Browse" to select a structuring element from the Data Manager. In the Data Browser, you can select one item and click "OK". The selected data name appears in the text field.

Options for FFT

Description

The Fast Fourier Transform (FFT) algorithm is an important tool in image processing. It "transforms" an image from the spatial domain into the frequency domain where the spectral components of the image can then be observed and/or manipulated using various frequency filters and algorithms. Once an image has been transformed, it must be inverse transformed (FFT Inverse) before it can be displayed as an image again.

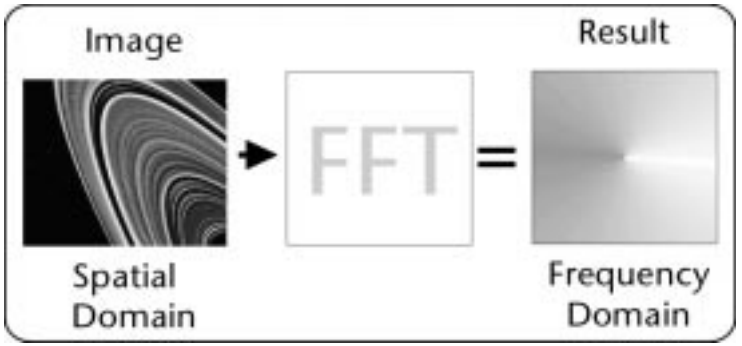


Figure 6-10: Fast Fourier Transform

Typical Uses

Use FFT to perform various types of frequency analysis on an image (e.g., lowpass, bandpass, highpass filtering).

Note The current version of Insight does not incorporate specific frequency filtering tools; however, the advanced user has the option of applying conditioning tools, the The Formulator, PlugIns, and the IDL language to perform Fourier analysis.

Algorithm Droplist

From the droplist, select FFT. Dialog options for this algorithm are displayed.

Note For more information, see FFT in the *IDL Reference Guide* and "Image Display Routines" in Chapter 13 of *Using IDL*.

Fields Unique to the FFT Dialog

There are no fields unique to this dialog. See "The Process Image Dialog" on page 132 for a discussion of the fields that are common to all of the image processing dialogs.

Options for FFT Inverse

Description

The Fast Fourier Transform Inverse (FFT Inverse) algorithm "re-transforms" an image from the frequency domain back into the spatial domain. The image can then be displayed.

Typical Uses

Use FFT Inverse after doing frequency analysis on an image (e.g., lowpass, bandpass, highpass filtering).

Note You cannot use FFT Inverse on a raw image. The image must first have an FFT performed on it, frequency domain manipulations (filtering) applied, and then an FFT Inverse can be performed. The current version of Insight does not incorporate specific frequency filtering tools; however, the advanced user has the option of applying conditioning tools, the The Formulator, PlugIns and the IDL language to perform Fourier analysis.

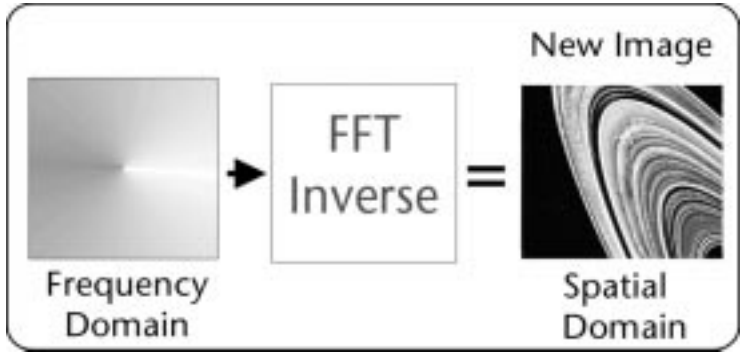


Figure 6-11: Fast Fourier Transform Inverse

Algorithm Droplist

From the droplist, select FFT Inverse. Dialog options for this algorithm are displayed.

Note For more information, see FFT in the *IDL Reference Guide* and "Image Display Routines" in Chapter 13 of *Using IDL*.

Fields Unique to the FFT Inverse Dialog

There are no fields unique to this dialog. See "The Process Image Dialog" on page 132 for a discussion of the fields that are common to all of the image processing dialogs.

Options for Flip Horizontal

Description

The Flip Horizontal function will rotate the image around a vertical axis which runs down the center of the image.

Typical Uses

Use Flip Horizontal to obtain a mirror of the original image.

Algorithm Droplist

From the droplist, select Flip Horizontal. Dialog options for this algorithm are displayed.

Note For more information, see REVERSE in the *IDL Reference Guide* and "Image Display Routines" in Chapter 13 of *Using IDL*.

Fields Unique to the Flip Horizontal Dialog

There are no fields unique to this dialog. See "The Process Image Dialog" on page 132 for a discussion of the fields that are common to all of the image processing dialogs.

Options for Flip Vertical

Description

The Flip Vertical function will rotate the image around a horizontal axis which runs through the center of the image.

Typical Uses

Use Flip Vertical to turn an image upside down.

Algorithm Droplist

From the droplist, select Flip Vertical. Dialog options for this algorithm are displayed.

Note For more information, see REVERSE in the *IDL Reference Guide* and "Image Display Routines" in Chapter 13 of *Using IDL*.

Fields Unique to the Flip Vertical Dialog

There are no fields unique to this dialog. See "The Process Image Dialog" on page 132 for a discussion of the fields that are common to all of the image processing dialogs.

Options for Lee Filter

Description

Lee filtering is a standard deviation-based (sigma) filter used to smooth noisy (speckled) data. Unlike similar sigma filters, the Lee filter preserves image sharpness and detail while suppressing noise.

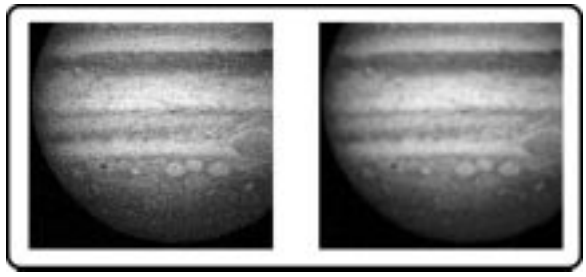


Figure 6-12: Noisy Image and Lee Filtered Image (Jupiter)

Typical Uses

The Lee filter is a standard method of removing noise from an image. It can also be used to produce image effects.

Algorithm Droplist

From the droplist, select Lee Filter. Dialog options for this algorithm are displayed.

Note For more information, see LEEFILT in the *IDL Reference Guide* and "Image Display Routines" in Chapter 13 of *Using IDL*.

Fields Unique to the Lee Filter Dialog

There are no fields unique to this dialog. See "The Process Image Dialog" on page 132 for a discussion of the fields that are common to all of the image processing dialogs.

Options for Roberts Edge Enhance

Description

The Roberts Edge Enhance filter is a method of sharpening and isolating the edges of an image.

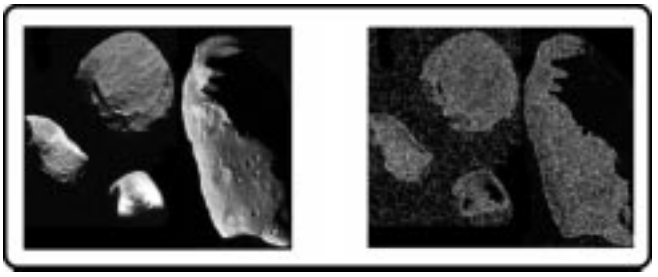


Figure 6-13: Original and Roberts Filtered Ir

Typical Uses

The Roberts filter is useful when viewing the edges and margins of an image is important. It can also be used to produce image effects.

Algorithm Droplist

From the droplist, select Roberts Edge Enhance. Dialog options for this algorithm are displayed.

Note For more information, see ROBERTS in the *IDL Reference Guide* and "Image Display Routines" in Chapter 13 of *Using IDL*.

Fields Unique to the Roberts Edge Enhancement Dialog

There are no fields unique to this dialog. See "The Process Image Dialog" on page 132 for a discussion of the fields that are common to all of the image processing dialogs.

Options for Rotate

Description

The Rotate function rotates an image or other 2D array by the specified angle.

Typical Uses:

Use the Rotate function to rotate an image or 2D array.

Algorithm Droplist

From the droplist, select Rotate. Dialog options for this algorithm are displayed.

Note For more information, see ROTATE or ROT in the *IDL Reference Guide* and "Image Display Routines" in Chapter 13 of *Using IDL*.

Fields Unique to the Rotate Dialog

The following fields are unique to this dialog. See "The Process Image Dialog" on page 132 for a discussion of the fields that are common to all of the image processing dialogs.

Degrees Panel

From the Degrees Panel, select the number of degrees to rotate the image in the clockwise direction.

Preserve Aspect Ratio Checkbox

Select this checkbox to preserve the image aspect ratio.

Options for Sobel Edge Enhance

Description

The Sobel Edge Enhance filter is similar to the Roberts Edge Enhance filter. It provides another means of image edge sharpening and isolation.

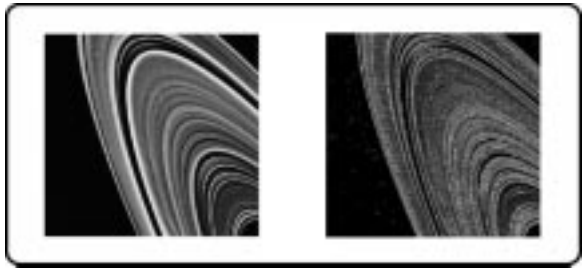


Figure 6-14: Original and Sobel Filtered Image (Saturn's rings)

Typical Uses

As with the Roberts filter, use the Sobel filter when viewing the edges or margins of an image is important. It can also be used to produce image effects.

Algorithm Droplist

From the droplist, select Sobel Edge Enhance. Dialog options for this algorithm are displayed.

Note For more information, see SOBEL in the *IDL Reference Guide* and "Image Display Routines" in Chapter 13 of *Using IDL*.

Fields Unique to the Sobel Edge Enhancement Dialog

There are no fields unique to this dialog. See “The Process Image Dialog” on page 132 for a discussion of the fields that are common to all of the image processing dialogs.

Options for Thin

Description

The Thin algorithm is a method of displaying the skeleton or outline of an image.

Typical Uses

Use thinning to view the outline or skeleton of an image.

Algorithm Droplist

From the droplist, select Thin. Dialog options for this algorithm are displayed.

Note For more information, see THIN in the *IDL Reference Guide* and “Image Display Routines” in Chapter 13 of *Using IDL*.

Fields Unique to the Thin Dialog

There are no fields unique to this dialog. See “The Process Image Dialog” on page 132 for a discussion of the fields that are common to all of the image processing dialogs.

Options for Transpose

Description

The Transpose algorithm will transpose the rows and columns in the image array. The resulting image will be a mirror of the original image rotated 90 degrees clockwise.

Typical Uses

Use the Transpose algorithm to change between row-major and column-major organization.

Algorithm Droplist

From the droplist, select Transpose. Dialog options for this algorithm are displayed.

Note For more information, see TRANSPOSE in the *IDL Reference Guide* and “Image Display Routines” in Chapter 13 of *Using IDL*.

Fields Unique to the Transpose Dialog

There are no fields unique to this dialog. See “The Process Image Dialog” on page 132 for a discussion of the fields that are common to all of the image processing dialogs.

Options for Subtract

Description

The Subtract algorithm will "subtract" one image from another.

Typical Uses

Use Subtract to remove processed image data from the original image (e.g., Lee filtered image from original image).

Algorithm Droplist

From the droplist, select Subtract. Dialog options for this algorithm are displayed.

Fields Unique to the Subtract Image Dialog

The following fields are unique to this dialog. See "The Process Image Dialog" on page 132 for a discussion of the fields that are common to all of the image processing dialogs.

Image 2 Text Field and Browse Button

In the "Image 2" text field, enter a data name or click "Browse" to select an image to subtract from the first image. In the Data Browser, select one item and click "OK". The selected data name appears in the text field.

Options for Wavelet Transform

Description

The Wavelet Transform algorithm has several applications, particularly as a method of compressing an image down to a

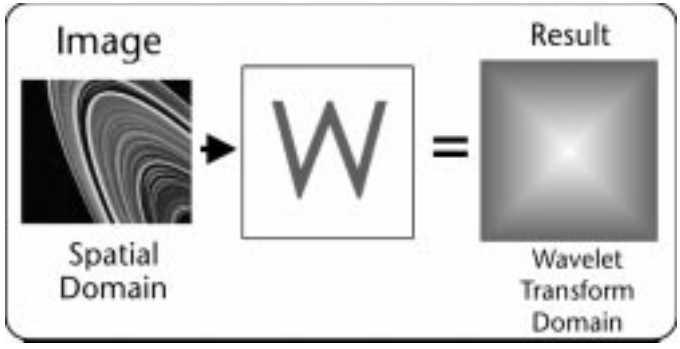


Figure 6-15: Wavelet Transform

smaller size and also as a fast solution in sparse linear algebra systems. For more information, see *Numerical Recipes in C: The Art of Scientific Computing (Second Edition), Cambridge University Press.*

Typical Uses

Use Wavelet Transform to compress an image (e.g., bitmap) down to a smaller-sized image. The Wavelet Transform can also be used for image effects. Note that Wavelet Inverse must be applied to view the transformed image. Wavelet Transform and Wavelet Inverse are useful only for images whose dimensions are powers of two (e.g., 64, 128, 256, 512). An advanced knowledge of image processing and the IDL language is recommended when using the Wavelet Transform.

Note For more information, see WTN in the *IDL Reference Guide* and "Image Display Routines" in Chapter 13 of *Using IDL*.

Algorithm Droplist

From the droplist, select Wavelet Transform. Dialog options for this algorithm are displayed.

Fields Unique to the Wavelet Transform Dialog

The following fields are unique to this dialog. See "The Process Image Dialog" on page 132 for a discussion of the fields that are common to all of the image processing dialogs.

Filter Coefficients Panel

In the panel, specify "4", "12", or "20" for the number of filter coefficients to be used in the transform process. Selecting a different number of filter coefficients enables the Wavelet Transform algorithm to use a different set of *Basis Functions* in the representation of the data.

Options for Wavelet Inverse

Description

The Wavelet Inverse Transform algorithm is a method of "re-transforming" an image after it has been Wavelet Transformed.

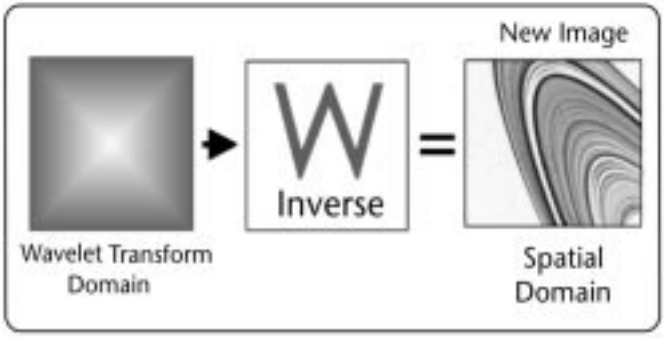


Figure 6-16: Wavelet Inverse Transform

Typical Uses

Use Wavelet Inverse Transform to view images that have been Wavelet Transformed. Note that Wavelet Inverse must always be applied to view the Wavelet Transformed image. Wavelet Transform and Wavelet Inverse are useful only for images whose dimensions are powers of two (e.g., 64, 128, 256, 512). An advanced knowledge of image processing and the IDL language is recommended when using Wavelet Transform/Inverse.

Algorithm Droplist

From the droplist, select Wavelet Inverse. Dialog options for this algorithm are displayed.

Note For more information, see WTN in the *IDL Reference Guide* and "Image Display Routines" in Chapter 13 of *Using IDL*.

Fields Unique to the Inverse Wavelet Transform Dialog

The following fields are unique to this dialog. See "The Process Image Dialog" on page 132 for a discussion of the fields that are common to all of the image processing dialogs.

Filter Coefficients Panel

In the panel, specify "4", "12", or "20" for the number of filter coefficients to be used in the transform process. Selecting a different number of filter coefficients enables the Wavelet Inverse algorithm to use a different set of basis functions in the representation of the data.

Smoothing

Select the "Smooth" option to open a dialog which allows you to perform boxcar smoothing on selected data and specify criteria for the smoothing analysis. For more details, see "SMOOTH" in the *IDL Reference Guide*.

What is Smoothing?

Smoothing can be used to soften the edges of images or compensate for noise in images and signals. You can smooth data of any number of dimensions with a boxcar average

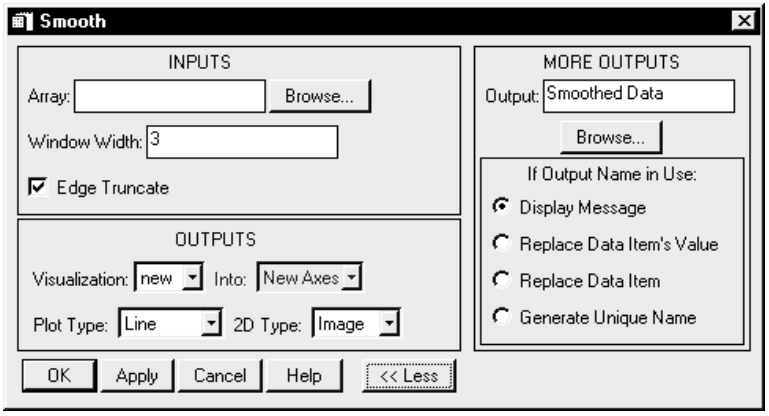


Figure 6-18: The Smooth Dialog

filter of a specified window width. A boxcar average filter will average around each data point according to the specified window width.

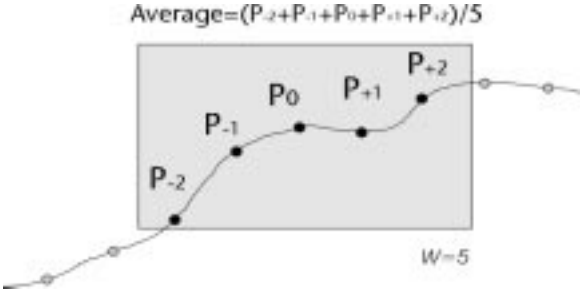


Figure 6-17: Smoothing with the Boxcar Average

For example, a boxcar average filter with a window width of 5 will average two points to the left of the data point, two points to the right, and the actual data point. The boxcar will move over each data point, doing the same calculation until all data points have been averaged.

The Smooth Dialog

This section describes the Smooth dialog options, which appear when you select the “Smooth” option of the Analyze menu in the Visualization window. The Smooth dialog is shown in Figure 6-18.

Array Text Field and Browse Button

In the "Array" text field, enter a data name or click "Browse" to select a data item to smooth. In the Data Browser, you can select one item and click "OK". The selected data name appears in the text field.

Window Width Text Field

In the "Window Width" text field, enter the desired width (also called sigma or Σ) for the smoothing window. Enter an odd number greater than three and less than the number of elements in the array.

Edge Truncate Checkbox

Select the "Edge Truncate" option to apply the smoothing function to all points. Edge Truncate determines what to do with the end points of the data. If the neighborhood around a point includes a point outside the array, the nearest edge point is used to compute the smoothed result. If you do not set Edge Truncate, end points are copied from the original array to the result with no smoothing.

Visualization Droplist

From the "Visualization" droplist, select one of three ways to visualize the fitted data in the Visualization window:

- none

  Your resulting data will not be visualized in the Visualization window, but if you click "OK" the data will be stored and listed as an item in the Data Manager.

- insert

  Insight inserts the visualization element of the resulting data into the visualization selected in the Visualization window. When you click "OK" the data will be stored in the project's Data Manager.

- new

  Insight visualizes your data in the next available space in the window's tiling scheme. When you click "OK" the data will be stored in the project's Data Manager.

Into Droplist

Use these menu options to select the axes used:

- New Axis

  Use new X and Y axes.

- Other

  Insert plot into the pair of axes listed.

Plot Type Droplist
Use these menu options to select the type of plot: Line, Scatter, or Histogram.

2D Type Droplist
When smoothing two-dimensional data, select either the Image or Surface option.

More >> Button
Click this button to view additional options.

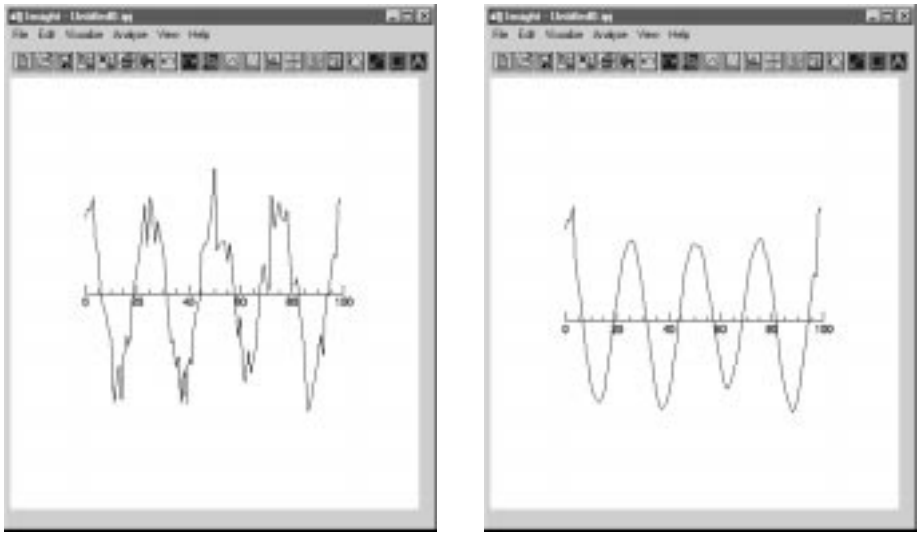
<< Less Button
(This option appears when you select the dialog's "More >>" button.) Click this button to close the extended section of the dialog that displays additional options for performing the analysis. The dialog displaying the basic dialog options remains open.

If Output Name in Use
Choose the appropriate button to determine how duplicate data names will be handled:

- Display Message - Displays a dialog warning message if the Output data name is already in use by another data item.
- Replace Data Item's Value - Replaces the "value" of an existing data item of the same name. This will result in dynamic updating of any current uses of that item, where possible. For example, a visualization would automatically attempt to redraw using the new value.
- Replace Data Item - Replaces the data item, i.e., the old data item will be deleted and a new one will be created. Future use of the old item will no longer be possible. For example, if an old item was being visualized, you would loose the ability to edit its properties.
- Generate Unique Name - Generates a unique (unused) name for the data item.

Output Text Field and Browse Button

(This option appears when you select the dialog's "More >>" button.) To save the output data generated by this analysis to a name other than the default name listed in the text field, click in the text field and edit or click the "Browse..." button and select a data item.



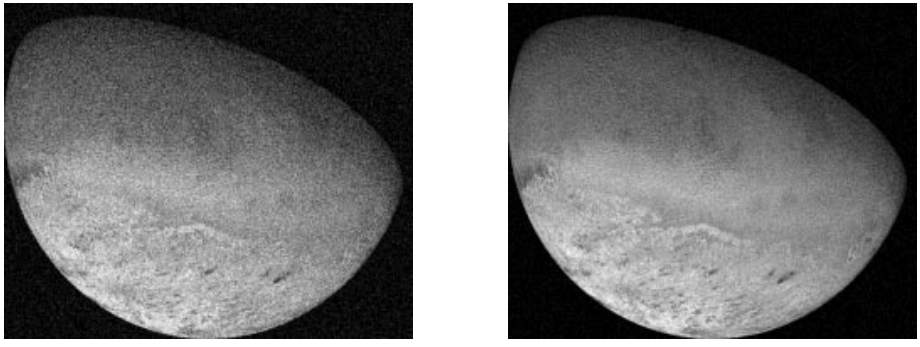


Figure 6-19: Top: Noisy Sine Wave and Smoothed Sine Wave. Bottom: Noisy Image (Neptune's moon Triton) and Smoothed Image

The Formulator

The Formulator gives you the power to create and evaluate formulas. A *formula* is like any other IDL expression, except that it can contain Insight data items (the names of data items are enclosed in vertical bars), and the result is optionally placed into an Insight data item (see Result Data Name).

This section provides an overview of Formulator features. For more detail on specific options, see Chapter 3, "Expressions and Operators" of *Building IDL Applications.*

Select the "Formulator" option from the Analyze Pulldown Menu to open the Formulator.

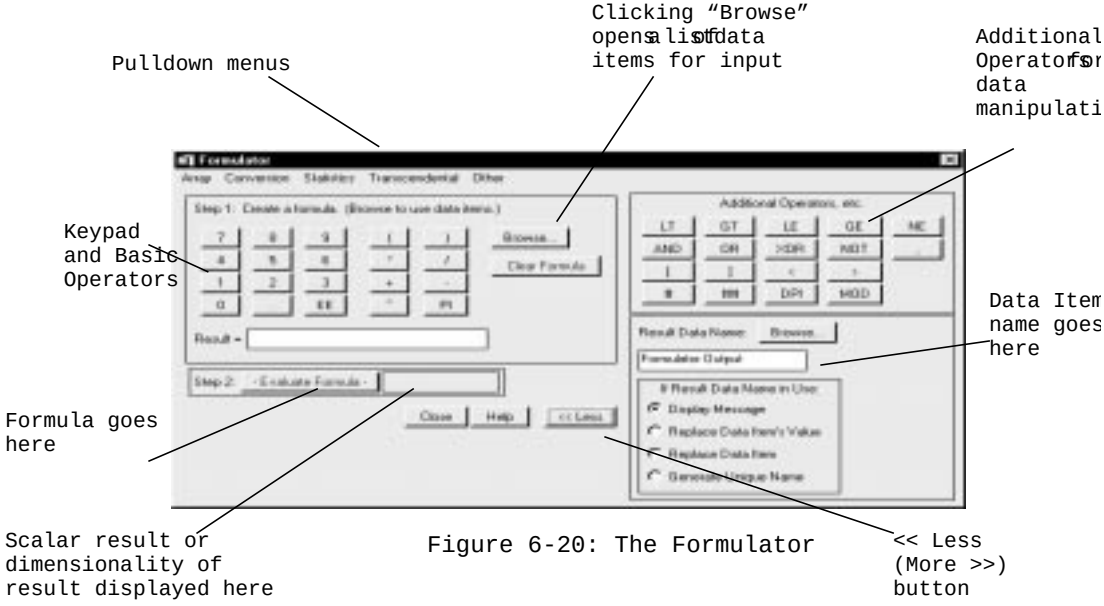


Figure 6-20: The Formulator

Browse Button

Clicking on the "Browse" button (located beside the Basic Operators) brings up the Data Browser which allows you to choose from a list of data items which can be used for arguments of formulas.

Double-click on the data item to bring it into the formulator.

Note All IDL data items used in a formula must be enclosed by the vertical bar character ("|").

Clear Formula Button

Clicking "Clear Formula" clears the Formula field of all input.

Evaluate Formula Button

When you have finished creating a formula, click the "- Evaluate Formula -" button to compute the result of the expression shown in the Formula field.

Result Data Name Text Field and Browse Button

Choose the appropriate button to determine how duplicate data names will be handled:

- Display Message - Displays a dialog warning message if the Output data name is already in use by another data item.
- Replace Data Item's Value - Replaces the *value* of an existing data item of the same name. This will result in dynamic updating of any current uses of that item, where possible. For example, a visualization would automatically attempt to redraw using the new value.
- Replace Data Item - Replaces the data item, i.e., the old data item will be deleted and a new one will be created. Future use of the old item will no longer be possible. For example, if an old item was being visualized, you would loose the ability to edit its properties.
- Generate Unique Name - Generates a unique (unused) name for the data item.

To save the output data generated by the formula to a name other than the default name listed in the text field, click in the text field and edit or click the "Browse..." button and select a data item.

Note If the output is a scalar, an output data name need not be specified. In this case, the Formulator behaves much like a typical scientific calculator, the result being displayed in the text field next to the "- Evaluate Formula -" button.

Steps for Creating a Formula

Following are the two basic steps for creating a formula. The example below gives a more detailed explanation of these steps.

1. Create the Formula

   Use the pulldown menus, numeric keypad, and/or additional operators to create a formula. You provide a name for the output data item by clicking "More >>" and

entering a name in Result Data Name. If you do not enter a name, the result will be named "Formulator Output".

Note Be sure to check the appropriate box in the "If Result Data Name in Use" list described above.

2. Evaluate the Formula

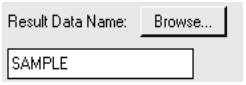
   Click on the "- Evaluate Formula -" button to evaluate the formula. Note that once you evaluate the formula, the result is put into a data item (if Result Data Name is specified) and it can be manipulated in the usual fashion and also be accessed using the Data Manager. You can re-do steps 1 and 2 as often as you like.

Formulator Example

In the following example, we will create a data item called SAMPLE, a 50-element array set to its index value, and calculate its median value. The result will be stored in the data item Med Samp.

1. From the Pulldown Menu, select **"Array"**, **"Findgen(X)"**, and then enter the number **50** in place of "X".

2. Click on the **"More >>"** button and enter the name `"SAMPLE"` into *Result Data Name*.

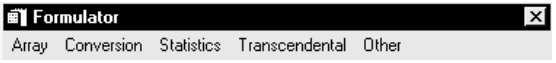


(Steps 1 and 2 may be reversed.)

3. Now click on **"- Evaluate Formula -"** to evaluate the equation and create the data item.

4. Click on **"Clear Formula"** to clear the formula area.

5. From the Pulldown Menu, select **"Statistics"** and **"Median(X)"**.



6. You can now either use **"Browse..."** to insert "SAMPLE" or you can type it in as |SAMPLE| making sure you put the "|" character around the data item.

7. Before clicking on **"- Evaluate Formula -"** remember to change *Result Data Name* to a name besides "SAMPLE". For this example, we use "Med Samp".

8. Once you have chosen a new name, click on **"- Evaluate Formula -"** and you should get a value of 24.5000 for Med Samp.

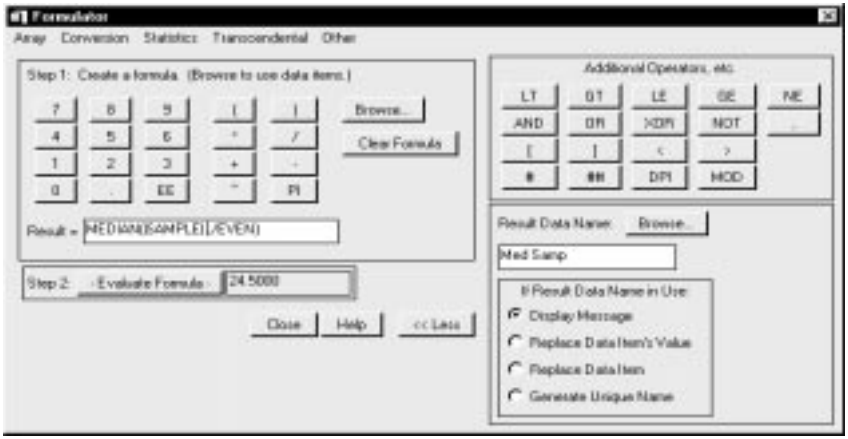


Figure 6-21: Formulator Example

With this example, we have just created two new data items, "SAMPLE" and "Med Samp", both of which are now available for use in the Formulator or the Data Manager.

Basic Data Types

The following table lists attributes which are supported by Insight's Formulator just the same as they are in IDL.

Byte	Unsigned integers from 0 to 255.
Integer	Integers from -32768 to +32767.
Long	Integers from 2^{-31} to 2^{31}-1.
Float	32-bit, single-precision, floating-point number in the range of $\pm 10^{38}$(IEEE)
Double Float	64-bit, double-precision, floating-point number in the range of $\pm 10^{308}$(IEEE)
Complex	A real, imaginary pair of floating-point numbers.
Double Complex	A [real, imaginary] pair of double-precision numbers.
String	A sequence of 0 to 32,767 characters.

Table 6-2: Formulator Data Types

Note The Formulator will convert the results to the highest precision value contained in the equation, as with any IDL expression. For example, if your equation contains an integer and a floating point number, the output will be floating point.

Pulldown Menu Options

The Formulator's menu bar provides access to a range of basic IDL functions. Select an item from one of the menus to place that function into the Formulator's formula field (the box with "Result =" to the left).

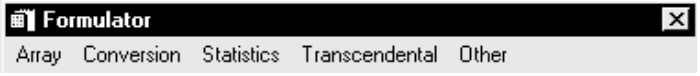


Figure 6-22: Formulator Pulldown Menu Options

For information about the various functions in the Formulator, see the *IDL Reference Guide*. (To use the online version of the *Reference Guide*, click the help viewer's "Contents" button and select "Main IDL Help File".)

Note You do not have to use the Formulator pulldown menus to create expressions and formulas for your data items. If you are familiar with the IDL language, you can type in your own expressions and formulas.

Array Menu

The Array menu provides access to functions used to create IDL arrays of different types (byte arrays, floating-point arrays, etc.). Options ending in "arr" (BYTARR, etc.) create arrays of the specified size, with each element set equal to zero. Options ending in "gen" (Findgen, etc.) create arrays of the specified size, with each element set equal to the one-dimensional array index of the element.

Bytarr(X)	Creates a byte array.
Complexarr(X)	Creates a single-precision, complex array.
Dblarr(X)	Creates a double-precision, floating-point array.
Dcomplexarr(X)	Creates a double-precision, complex array.
Fltarr(X)	Creates a floating point array.
Intarr(X)	Creates an integer array.
Lonarr(X)	Creates a long integer array.
Bindgen(X)	Creates a binary array with each value set to its index.
Cindgen(X)	Creates a complex, single-precision, floating-point array with each value set to its index.
Dcindgen(X)	Creates a complex, double-precision, floating-point array with each value set to its index.
Dindgen(X)	Creates a double-precision integer array with each value set to its index.
Findgen(X)	Creates a floating-point array with each value set to its index.
Indgen(X)	Creates an integer array with each value set to its index.
Lindgen(X)	Creates a longword integer array with each value set to its index.

Table 6-3: Formulator Array Menu Functions

Conversion Menu

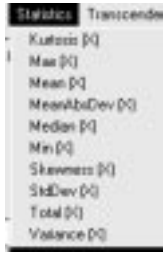
The Conversion menu provides access to functions used to convert data values from one coordinate system or data type to another.

Degrees -> Radians	Converts degrees to radians.
Radians - > Degrees	Converts radians to degrees.
Abs(X)	Absolute value (non-negative value).
Byte(X)	Converts to byte.
Bytscl(X)	Scales X such that the range is 0 to 255.
Ceil(X)	Returns the closest integer greater than or equal to X.
Double(X)	Converts to double precision.
Fix(X)	Converts to integer.
Float(X)	Converts to single-precision floating point.
Floor(X)	Returns the closest integer less than or equal to X.
Long(X)	Converts to long integer.
Round(X)	Rounds to the closest integer.
String(X)	Returns X converted to string type.
Complex(X)	Returns scalars or arrays in the form (real, complex) with all complex values set to 0.
Dcomplex(X)	Returns double-complex scalars or arrays in the form (real, complex) with all complex values set to 0.
Conj(X)	Computes the complex conjugate of X.
Imaginary(X)	Returns the imaginary value of X.

Table 6-4: Formulator Conversion Menu Functions

Statistics Menu

The Statistics menu provides access to commonly used statistical functions.



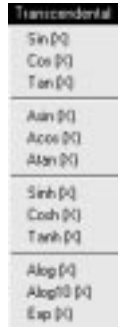
Kurtosis(X)	Calculates peakedness or flatness of the graph of a frequency distribution, especially with respect to the concentration of values near the mean as compared with the normal distribution.
Max(X)	Calculates maximum value.
Mean(X)	Calculates mean value (average).

Table 6-5: Formulator Statistics Menu Functions

MeanAbs-Dev(X)	Calculates mean absolute deviation which is the sum of the absolute distance of each sample element from the population (or set of values) mean.
Median(X)	Calculates the median (middle) value.
Min(X)	Calculates minimum.
Skewness(X)	Calculates skewness or lack of symmetry.
StdDev(X)	Calculates standard deviation which is the root mean square of the deviations (distances) from the population mean.
Total(X)	Calculates total of all values in X.
Variance(X)	Calculates variance which is the square of the standard deviation.

Table 6-5: Formulator Statistics Menu Functions

Transcendental Menu



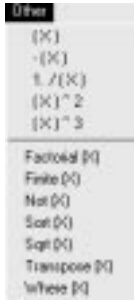
The Transcendental menu provides access to transcendental functions (SIN, COS, exponents, etc.).

Sin (X)	Sine of X.
Cos(X)	Cosine of X.
Tan(X)	Tangent of X.
Asin(X)	Arc Sine; returns the angle (in radians) whose sine is X.
Acos(X)	Arc Cosine; returns the angle (in radians) whose cosine is X.
Atan(X)	Arc Tangent; returns the angle (in radians) whose tangent is X.
Sinh(X)	Hyperbolic Sine.
Cosh(X)	Hyperbolic Cosine.
Tanh(X)	Hyperbolic Tangent.
Alog(X)	Natural logarithm (Base e).
Alog10(X)	Logarithm (Base 10).
Exp(X)	Natural exponential (e^X).

Table 6-6: Formulator Transcendental Menu Functions

Other Menu

The Other menu provides access to a selection of other generally useful functions.



(X)	Provides an insertion point for X.
-(X)	Multiplies by -1.
1./(X)	Computes the inverse of X.
(X)^2	Computes the square of X (X^2).
(X)^3	Computes the cube of X (X^3).
Factorial(X)	Computes the factorial (X!) of X.
Finite(X)	Returns a value of 1 if the argument is true.
Not(X)	Returns the Boolean inverse of X using 2's complement representation.
Sort(X)	Returns a vector of subscripts of X (an index) which allows access to the elements of X in ascending order. Sort does *not* directly sort the values in X. (See the *IDL Reference Guide* for more information.)
Sqrt(X)	Computes the square root of X.
Transpose(X)	Computes the transpose of array X. (X must be an array.)
Where(X)	Returns a longword vector that contains the one-dimensional subscripts of the nonzero elements of the array X.

Table 6-7: Formulator Other Menu Functions

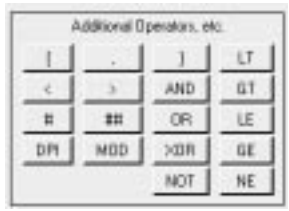
Basic Operators

The Formulator contains buttons for numbers, operators, and symbols for common operations such as multiplication, division, addition, subtraction, and exponentiation. To insert or use one of these, simply click the desired button.

0,1,2,...,9	Digits
EE	Exponential (e.g., 10^X)
( )	Parentheses to enclose arguments [e.g., Findgen(100)]
*	Multiplication
+	Addition
-	Subtraction
/	Division
PI	Single precision value of pi.

Table 6-8: Formulator Basic Operators

Additional Operators



Click “More >>” to extend the Formulator and access additional operators. See Chapter 3, “Expressions and Operators” of *Building IDL Applications* for more details.

[ ]	Brackets to enclose arrays (e.g., x[10,5])
<	Minimum operator
>	Maximum operator
,	Comma
#	Array multiplication (column x row)
##	Matrix multiplication (row x column)
DPI	Double-precision PI
MOD	Returns the remainder of division
AND	And
OR	Or
XOR	Exclusive Or
NOT	Not
LT	Less than
GT	Greather than
LE	Less than or Equal to
GE	Greater than or Equal to
NE	Not Equal to

Table 6-9: Formulator Additional Operators

PlugIns

Select this option to view a submenu of Analysis PlugIns. Selecting one of the PlugIns displayed performs the PlugIn's analysis operation on the item selected in the Visualization and/or on data items.

A PlugIn is a routine written in the IDL language. PlugIns must follow Insight's PlugIn conventions as described in Chapter 9 (Extending Insight). Analysis PlugIns behave the same as built-in analysis functionality, thus can be undone and redone. See "Analysis PlugIns" on page 212 for details on writing your own Analysis Plugins.

Chapter 7

Insight Tutorials

The following topics are covered in this chapter:

Tutorial 1: Starting Insight and Opening a Project 165
Tutorial 2: Visualizations, Styles, and Printing 167
Tutorial 3: Visualizing a Contour 170
Tutorial 4: Visualizing a Surface 172
Tutorial 5: Analyzing Data and Annotating 174
Tutorial 6: Curve Fitting Analysis 178
Tutorial 7: Working in the Data Manager Window 180
Tutorial 8: Importing ASCII Data 184

This chapter guides you through tutorial examples that demonstrate common Insight operations. You'll learn how to visualize data, modify properties, and perform several types of data analysis. Before reading through these tutorials, you should have a good idea of how to work with the interface features native to your operating system as well as those specific to the Insight interface. It also would be helpful for you to review the following chapters and topics:

- Chapter 2, "Getting Started";
- "Importing and Exporting Data" on page 34;
- "What Is Visualization?" on page 50; and
- "The Visualization Window" on page 50.

Tutorial 1:
Starting Insight and Opening a Project

This tutorial walks you through steps for opening a project and saving your changes.

What You'll Learn

In this tutorial, you'll learn how to:

- Start Insight
- Open an existing project
- Modify the project
- Save the project
- Exit Insight

Exercise 1: Start Insight and Open a Project

There are two ways to start the Insight application — from within IDL or from your computer's window system or system command prompt.

The way you start Insight from the computer's window system or command prompt depends on the operating system you are using:

Microsoft Windows

Double click on the Insight icon in the IDL program group or select Insight from the IDL section of the Start menu.

Macintosh

Double-click on the Insight icon in the IDL folder.

Unix or VMS

Enter `insight` at the system command prompt. Note that if you (or your system administrator) did not create links to IDL and Insight when installing IDL, you may need to either change to the IDL directory or give a full path name. Consult your system administrator if simply entering `insight` at the prompt does not start Insight.

Starting Insight from within IDL gives you access to all of IDL's functionality along with Insight. You can move IDL variables into and out of Insight from the IDL command line. To start Insight from within IDL, enter `insight` at the IDL command prompt. Starting Insight from within IDL also allows you to specify keywords to the Insight procedure at startup; you cannot do this if you start Insight from the operating system.

Note In Windows, starting Insight without first starting IDL runs Insight in *runtime mode*. This means that even though IDL is running (IDL must be running for Insight to run), you will not have access to the IDL Development Environment or the IDL command prompt.

When you start Insight for the first time, the Getting Started with Insight dialog opens. This dialog presents a list of the three most recently opened Insight projects. If you have not used Insight before, three example projects will be listed in the dialog; these are project files provided by Research Systems as examples of what Insight can do. Select `example2.ipj` from the list and click "OK". (If `example2.ipj` is not listed, select "Other Projects" to open a file selection dialog. Browse to the `project` subdirectory of the `insight` subdirectory of the `examples` directory in the IDL distribution and select `example2.ipj` and click "OK".) The project's Visualization window appears on the screen.

Exercise 2: Modify the Project

Explore the Insight project for a while before continuing with this exercise.

Note Do not save the following changes to the example project. After finishing modifications, we will save the project as another name.

1. First, let's remove the existing visualizations. Select "Clear" from the Visualization window's View menu.
2. The `example2.ipj` project file has a tiling scheme for two visualizations. Let's change that to one. To do this, select "1 By 1 (Rows By Columns)" from the View menu.
3. Create a new visualization by selecting "Surface" from the Visualize menu. Click once in the "Z" checkbox shown next to the "Sombrero" data, and click "OK". Insight creates a surface plot using the default surface style.
4. Double-click on the surface to bring up the properties dialog. Pick a color you like from the "Top Color" droplist. Click "OK".

Exercise 3: Save the Project with a New Name

When you have finished making modifications to the project file, save it with a new name:

1. Select "Save As" from the File menu in the Visualization window. A "Save Project As" dialog opens.
2. In the dialog, select a directory in which to place the file. Save the file as `tutorial.ipj`.
3. In the dialog, click "OK."

When you next open this project file, it will display the visualization as you have left it.

Exercise 4: Exit Insight

Select "Exit" from the File menu. Insight quits and all projects are closed. If you have any unsaved projects, Insight will prompt you to save them.

Tutorial 2:
Visualizations, Styles, and Printing

Insight makes visualizing data simple. This tutorial walks you through steps for visualizing a data item in the Visualization window and modifying its properties.

What You'll Learn

In this tutorial, you'll learn how to:

- Create different visualizations
- Modify properties
- Insert plot lines
- Save a visualization style
- Apply a style to a visualization
- Annotate and print a visualization

Exercise 1: Open the Tutorial Project

1. If you have not already done so, follow the steps in Tutorial 1, "Starting Insight and Opening a Project" on page 165 to generate tutorial.ipj.
2. Start Insight. (See "Start Insight and Open a Project" on page 165 if you're unsure how to do this.) The `tutorial.ipj` file should be selected in the Getting Started dialog (see Exercise 3 in Tutorial 1 for an explanation of creating `tutorial.ipj`). Click "OK" to open the tutorial project. Notice that the visualization window opens in the same place you left it when you saved the tutorial file.

Exercise 2: Create Another Visualization

1. Let's start with an empty visualization window. Select "Clear" from the View menu to clear the existing display.
2. Create a line plot in the Visualization window. Select Line Plot from the Visualization menu. The Line Plot dialog opens, displaying a list of data items. (Insight displays only those data items that are appropriate for Line plots.) Click once in the "Y" checkbox next to "Damped Sine 180" and click "OK". The line plot is drawn in the visualization window using the default plot style.

Exercise 3: Modify Properties

1. Now, modify some of the properties of the Line plot. Double-click on the plot line to bring up its dialog. A Properties dialog opens displaying all of the plot line's visual characteristics.
2. From the "Color" droplist, select "Green". From the "Line Type" droplist, select "Dashed". From the "Symbol" droplist, select "Diamond". Adjust the symbol size slider to "2". Each click increases or decreases the thickness by an increment of one; the thickness is displayed

above the slider. Click “Apply”. Notice that the plot line in the window is now dashed and green. Since you clicked “Apply,” these changes are only temporary.

3. Make more changes. Adjust the “Thickness” slider to “3”. Let’s change the color again. From the “Color” droplist, select “Blue”. This time, make the changes permanent by clicking “OK”. The Properties dialog closes and the plot line’s properties have been changed to a blue dashed line style with a thickness of 3.

4. Now modify the color of the X and Y axes. Double-click on the “Y” axis. A Properties dialog opens. From the “Color” droplist select “Red” and click “OK”. Double-click on the “X” axis. A Properties dialog opens. From the “Color” droplist select “Red” and click “OK”. The axes in the Visualization window and their labels are now red.

Exercise 4: Save a Visualization Style

1. Let’s save the “look” of this visualization as a style. Select “Save Style” from the Edit menu. The “Save Visualization Style” dialog opens. Enter “MyStyle1” in the “Name” field and click “OK”.

2. Make sure you save this and all changes to the project by selecting “Save Project” from the File menu.

Exercise 5: Inserting a Plot Line

1. Let’s insert another line into this plot. Select “Insert Plot” from the Edit menu. Select the “Y” column of the Sine 360 data item. Note that the “Insert Into:” droplist is set to “X Axis / Y Axis”. Click “OK”. Notice how the X axis resized itself to fit the new total range. The legend has also updated to reflect the added data.

2. Now let’s modify the properties of the X axis. Double-click on the X axis. Select the “Log” checkbox and click “OK”. The X axis is now a log axis, and the data sets have adjusted to reflect this new state.

3. Now let’s insert another line giving it a new pair of axes. Select “Insert Plot” from the Edit menu. Select the “Y” column of the Cosine 360 data item. Modify the “Insert Into:” droplist to “New Axes”. Click “OK”. Notice that the Cosine data has been added to the graph with its own set of axes. The legend has also updated to reflect the added data.

Exercise 6: Visualize another Data Item

1. Let’s visualize another data item, Noisy Damped Sine 180, as a Scatter plot. Since we don’t need to save the visualization of the line plot, we can either:

   - visualize another data item which automatically will replace the line plot (since “Retain All Visualizations” is not selected from the View menu, by default); or
   - select “Clear” from the View menu.

   Let’s go ahead and clear the window by selecting “Clear” from the View menu.

2. Now select “Scatter Plot” from the Visualize menu. The Scatter Plot dialog opens with a list of data from which to choose.(Insight displays only those data items that are appropriate for Scatter plots.)

3. Select the “Y” column of the Noisy Damped Sine 180 data item. Now, suppose we want to apply a style. We could select an existing style from the droplist in this Scatter Plot dialog, but let’s wait until after we visualize so we can see how the scatter plot appears in the window. Click “OK”. Insight displays a Scatter plot of Noisy Damped Sine 180 in the Visualization window.

Exercise 7: Apply a Style to a Visualization

Now let’s apply the style we created earlier to the scatter plot. Select “Apply Style” from the Edit menu. A submenu of existing styles appears. Select “MyStyle1”. The Scatter plot’s symbol style has been changed to a blue diamond. The color of the axes and axes labels are now red.

Exercise 8: Annotate and Print the Visualization and Close the Project

1. Let’s label the visualization with its visualization type and style. To do so, click the Text annotation toolbar button (which shows the letter “A”) on the far right-hand side of the Visualization Toolbar (located below the Visualization window menu bar). A text annotation appears on the visualization. Click on the annotation and hold down the mouse button; drag the text annotation towards the top of the visualization window.

2. Double-click on the annotation to open the Text Annotation Properties dialog. Double-click in the “Text” text field and enter “Scatter Plot in MyStyle1”. From the “Font” droplist select “Times”. Adjust the “Font Size” slider to “14”. Click “OK” to close the Properties dialog. You will notice that the text annotation now reads “Scatter Plot in MyStyle1”.

3. Select “Save Project” from the File menu to save these changes to the project.

4. Select “Print” from the File menu to print the contents of the Visualization window on your system printer. By default, Insight will scale your visualization to fit the page. You can alter this behavior by modifying the “Print Scaling” settings in Insight’s General Preferences dialog. See “Preferences Dialog: General” on page 22 for details.

5. Select “Exit” from the File menu. Remember that the next time you open this project, the Visualization window will appear with the Scatter Plot displayed.

Tutorial 3: Visualizing a Contour

This tutorial walks you through steps for visualizing a contour over an image in the Visualization window and modifying its properties.

What You'll Learn

In this tutorial, you'll learn how to:

- Visualize an Image
- Visualize a Contour
- Modify Contour Properties
- Modify Properties of a Visualization

Exercise 1: Start Insight and Open a Project

1. If you have not already done so, follow the steps in Tutorial 1, "Starting Insight and Opening a Project" on page 165 to generate tutorial.ipj.

   Hint Start IDL, then start Insight by entering the following at the IDL command prompt: (Note: If your display only supports 256 colors, you should start Insight at the IDL command prompt.)

   ```
   insight, /indexed_color
   ```

   Note This starts Insight in indexed-color mode. By default, Insight runs in true-color, or 24-bit color, mode. Using indexed-color mode is only necessary if your display device (video card) uses 8-bit color rather than 24-bit color. If displaying an X display server that does not support pseudo color, indexed color mode in Insight will not work.

2. The `tutorial.ipj` file should be selected in the Getting Started dialog (see Exercise 3 in Tutorial 1 for an explanation of creating `tutorial.ipj`). Click "OK" to open the tutorial project. Now we're ready to begin visualizing data.

Exercise 2: Visualize an Image

1. First, set up the Visualization window so that it displays two visualizations side by side. Select "Clear" from the View menu, then select "1 By 2" from the View menu. Increase the width of the Visualization window by dragging one of the sides until the draw area is twice as wide as it is tall.

2. Let's visualize an image. Select "Image" from the Visualize menu. In the dialog, select the "Pool Pebble" data and click "OK". Insight displays the data in the left tile of the Visualization window.

3. Now select a new color table for the image. Double-click on the image to open the Properties dialog. Select "Eos B" from the "Color Table" list. Click "OK". Insight applies the new color table to the image.

Exercise 3: Visualize a Contour

1. Select "Contour" from the Visualize menu. In the dialog, select the "Z" box next to "Pool Pebble" and click "OK". Insight displays a visualization of the data as a contour in the right tile of the Visualization window.

2. Select the image visualization (not the image itself). Drag the top right and bottom right drag handles until the image is the same height as the Y axis of the contour visualization.

3. Select the whole contour visualization. There should be boxes in the four corners of the Visualization window. If there are no boxes, click once in the area around the contour plot. Select "<Contour Graph> Properties" from the Edit menu or double-click on a clear area within the contour to bring up the Properties dialog for the contour. Select "Background Transparent" and click "OK".

Exercise 4: Modify the Pool Pebble Contour

1. Double-click on one of the contour lines in the Visualization window. The Properties dialog for the contour opens.

2. Uncheck the default checkbox next to the Number of Levels field.

3. Enter "9" in the "Number of Levels" text field.

4. Let's modify the first contour levels. Select the first line in the table. From the color droplist, select "green". From the line style droplist, select "Dash Dot".

5. Let's remove the third contour levels. Select the third line in the table and click "Remove".

6. Click "OK" to accept the changes and notice the changes in the Visualization window.

7. Now select the contour visualization and drag it to the left until the axes of the contour visualization match the edges of the image.

8. Select "Exit" from the File menu. If you haven't saved the project file since your last change, Insight will prompt you to do so. Click "Yes" to save the project.

Tutorial 4: Visualizing a Surface

This tutorial walks you through steps for visualizing a surface in the Visualization window and modifying its properties.

What You'll Learn

In this tutorial, you'll learn how to:

- Visualize a surface
- Modify surface properties
- Rotate a surface

Exercise 1: Open the Tutorial Project

1. If you have not already done so, follow the steps in Tutorial 1, "Starting Insight and Opening a Project" on page 165 to generate tutorial.ipj.
2. Start Insight. (See "Start Insight and Open a Project" on page 165 if you are unsure about how to do this.) The `tutorial.ipj` file should be selected in the Getting Started dialog. Click "OK" to open the tutorial project (see Exercise 3 in Tutorial 1 for an explanation of creating `tutorial.ipj`). Notice that the visualization window opens in the same place you left it when you saved the tutorial file.

Exercise 2: Visualize a Surface

Let's visualize a surface. Select "Surface" from the Visualize menu. In the dialog, select the "Z" box next to "Domed Surface" and click "OK". Insight displays a visualization of the data in the Visualization window.

Exercise 3: Modify the Surface

1. In the Visualization window, double-click on the blue surface area. The Properties dialog for the surface opens.
2. From the "Bottom Color" droplist select "Green".
3. Click "OK" to accept the changes.

Exercise 4: Rotate the Surface

You'll notice that for this particular visualization we only can see the top color (blue). Let's rotate the surface so we can see the underside.

To rotate the surface click and hold down the mouse button near the center of the window. Slowly drag the mouse pointer straight up, continuing to hold the button down. You'll notice that the surface changes from a solid to a lower-resolution representation as you drag, and that the surface plot (and its axes) rotates away from you so that you can see the underneath. Release the mouse button and the solid surface is redisplayed. See "Preferences Dialog: General" on page 22 for information changing the quality of the visualization as you drag.

Insight's rotation feature works like a "virtual trackball". Imagine that there is an invisible sphere the size of the Visualization window located with its center at the center of the visualization. When you click the mouse button, it is as if you are clicking on the surface of this invisible sphere. Dragging the mouse pointer is like rotating the sphere in the direction the mouse moves.

Try some more rotations of the surface.

Hint Selecting and dragging works best with solid surfaces. If you try to rotate a wire-frame surface, it is more difficult to be sure you are clicking on the surface and not on the background.

4. Select "Save Project" from the File menu to save these changes to the project.
5. Select "Exit" from the File menu to exit Insight.

Tutorial 5:
Analyzing Data and Annotating

This tutorial walks you through steps for visualizing an image and performing image processing and correlation analyses on that visualization.

What You'll Learn

In this tutorial, you'll learn how to:

- Set up a tiling scheme in the window
- Visualize an Image
- Open Analyze dialogs for image processing analysis
- Generate new data
- Perform correlation analyses
- Modify properties of visualizations
- Create a text annotation
- Smooth Data

Exercise 1: Start Insight, Open the Tutorial Project, and Set Preferences

1. If you have not already done so, follow the steps in Tutorial 1, "Starting Insight and Opening a Project" on page 165 to generate tutorial.ipj.
2. Start IDL, then start Insight by entering the following at the IDL command prompt:

   insight, /INDEXED_COLOR

   Note This starts Insight in indexed-color mode, allowing us to work with images that have color tables associated with them. By default, Insight runs in true-color, or 24-bit color, mode. Using indexed-color mode is only necessary if your display device (video card) uses 8-bit color rather than 24-bit color.
3. The `tutorial.ipj` file should be selected in the Getting Started dialog (see Exercise 3 in Tutorial 1 for an explanation of creating `tutorial.ipj`). Click "OK" to open the tutorial project.
4. Select "Clear" from the View menu, then select "2 X 2" from the View menu to set up the Visualization window so we can visualize more than one data item at once. This option gives you a "tiling scheme" for four visualizations (two on the top row and two on the bottom.) Insight will place the first visualization in the lower, left-hand corner, the second in the lower right-hand corner, the third in the upper, left-hand corner, and the fourth in the upper right-hand corner.
5. Select "Preferences" from the file menu. Setting the number of reserved colors will not take effect until the next IDL session (not just Insight session) and only works if the first graphics window opened is the Insight Visualization Window. In the "Selection Visual

Options" panel in the lower right-hand side of the dialog, select "Yellow" from the color droplist. Now, every time you select something in the Visualization window, the selected item will be highlighted in yellow. Click "OK".

Now we're ready to begin visualizing and analyzing data.

Exercise 2: Visualize an Image

Let's visualize an image. Select "Image" from the Visualize menu. In the dialog, select the "Vibrations" data and click "OK". Insight displays a visualization of the image data in the lower left-hand corner of the Visualization window.

Exercise 3: Annotate an Image

1. Let's give the image a label or title to reflect that it represents the original data. To do so, click the Text annotation tool on the far right-hand side of the Visualization Toolbar (located at the top of the Visualization window). A text annotation appears on the visualization.

2. Double-click on the annotation to open the Text Annotation Properties dialog. Double-click in the "Text" text field and enter "Vibrations-Image1". Double-click in the "Name" text field and enter "Title-Image1".

   Note If you select the Visualization Manager, "Title-Image1" will be listed in the dialog as an element in the Visualization window which can be edited just like any other element such as a plot line, axis, image, etc.

   Adjust the "Font Size" slider to 9 and the color to Yellow. Click "OK" to close the Properties dialog. You will notice that the text annotation now reads "Vibrations-Image1".

3. Now let's move the annotation to the desired location. Click on the annotation and, holding down the mouse, drag it right above the visualization and center it.

Exercise 4: Process the Image

Now let's process the "Vibrations" image data.

1. Click once on the image to select it. Select "Process Images" from the Analyze menu. In the Process Image dialog you will notice that the name of the data, Vibrations, already appears in the "Image" text field so there's no need to browse to select data.

2. From the algorithm droplist, select "LeeFilter".

3. From the "Visualization" droplist, select "new" and click "More". The dialog extends to reveal more options. Click in the "Output" text field and enter a name for the new data item that will be created and placed in the Data Manager: "Image 2."

4. Click "OK". Insight visualizes the processed image named "Image2" in the second available space in the tiling scheme (the lower right space in the Visualization window). You'll notice that the Lee Filter processing caused the Image to appear lighter.

Exercise 5: Perform a Correlation

Now let's correlate the first and second images to see how they compare.

1. Select Image 2. Select “Correlate” from the Analyze menu.
2. In the Correlate dialog you will notice that the name of the data, Image2, already appears in the “Independent” text field so there’s no need to browse to select that data.
3. From the algorithm droplist, select “Image Correlation”.
4. Next to the “Independent 2” text field, click “Browse”. A Data Browser opens with a list of available images you can use for the correlation. Select the name of the original data we visualized first, “Vibrations”. Click “OK”. The name appears in the “Independent 2” text field. Insight will correlate the original data named “Vibrations” with the processed data (named “Image2”.)
5. Select “By Row” Orientation, and make sure the “Summary” checkbox is selected, and click “OK”. A Summary dialog appears with the correlation results. Make a note of the number displayed and click “OK.”

Exercise 6: Modify Properties

Select “Visualization Manager” from the Edit menu. Notice that both visualizations and their elements are listed. In this dialog select “Image 2” and click “Edit”. The Properties dialog for the image opens. In the “Color Table” list, select “Eos B” and click “OK”. Insight applies the selected color table to Image 2.

Note In indexed color mode, only one color table can be displayed at a time. This means that all the visualizations in the Visualization window are displayed using the color table that belongs to the selected item. If you select the original image (the one with the title “Vibrations - Image 1”) you’ll see both images in the color table associated with the first image.

If we perform an image correlation analysis again on the Vibrations image and Image 2, we would get the same correlation results. Changing the Properties of Image 2 only changed its appearance, not the image data itself.

Exercise 7: Annotate the Image

1. Add the correlation result as a text annotation to Image 2. Click in the second visualization and select the Text Annotation tool in the toolbar. After the text annotation appears on the visualization, double-click it. The Text Annotation Properties dialog opens.
2. In that dialog click in the “Text” text field and enter the following: “Correlation: .869864.” Adjust the “Font Size” slider to 9, the color to Red, and click “OK”. Drag the annotation to the top of the image.

Exercise 8: Smooth the Image Data

Now let’s visualize Image 2 and smooth the data to soften edges and compensate for random noise.

1. Select “Image” from the Visualize menu. Since analysis operations generate data, the Image 2 data (basically the “Vibrations” data processed with the Lee Filter algorithm) has been added to our data area and list of data choices. Select “Image2” and click “OK”. Insight visualizes the image in the third available space in the tiling scheme (the upper left-hand corner.)

2. Select the Image 2 in the window. Select “Smooth” from the Analyze menu. In the Smooth dialog you will notice that the name of the data “Image 2” already appears in the “Array” text field so there’s no need to browse to select data.

3. In the “Window Width” text field, make sure “3” appears as the desired width for the smoothing window.

4. De-select the “Edge Truncate” option so that smoothing is not applied to all points. Insight will copy end points from the original array to the result with no smoothing.

5. Click “More”. The dialog expands. Click in the “Output” text field and enter “Image 4” as the new name for the data.

6. From the “Visualization” droplist, select “new” and click “OK”. Insight visualizes the smoothed data in the next available space in the tiling scheme (the upper right space in the Visualization window).

Exercise 9: Process Image 4

1. Select Image 4. Once again, select “Process Images” from the Analyze menu. In the Process Image dialog you will notice that the name of the data, Image4, already appears in the “Image” text field.

2. From the algorithm droplist, select “Rotate Image”.

3. In the “Degrees Panel,” select “Other” and enter “10” in the “Other” text field. This will rotate the image 10 degrees clockwise. Check “Preserve Aspect Ratio” checkbox.

4. Click “More”. The dialog expands. Click in the “Output” text field and enter “Image 5” as the new name for the data.

5. From the “Visualization” droplist, select “new” and click “Apply” so we can just view it on a trial basis. When you request a new visualization, Insight will go ahead and place it in the next available space. Even though the next available space in our tiling scheme (the lower left space) is occupied by the first visualization, Insight replaces it with the fifth visualization. Click “OK”.

   See “Retain All Visualizations” on page 65 for more on how tiling schemes like this interact with the setting of the “Retain All Visualizations” property.

6. As you can see the image appears rotated slightly. Now select the “Undo” toolbar button (the eighth button from the left in the Visualization toolbar). The rotated image disappears and the original image reappears. Choosing “undo” not only reverses the visualization but also the analysis; because we selected “undo” Insight will not generate new data reflecting the rotate image analysis. If we had performed another action or saved the project before selecting “Undo,” we would not have been able to undo the rotation.

7. Select “Exit” from the File menu. Insight will prompt you to save the project. Click “No”. The tutorial project closes and the Insight application quits without saving changes.

Tutorial 6:
Curve Fitting Analysis

This tutorial walks you through steps for fitting a curve to data.

What You'll Learn

In this tutorial, you'll learn how to:

- Perform Fit Curve Analysis

Exercise 1: Open the Tutorial Project

1. If you have not already done so, follow the steps in Tutorial 1, "Starting Insight and Opening a Project" on page 165 to generate tutorial.ipj.
2. Start Insight (see "Tutorial 1: "Starting Insight and Opening a Project" on page 165 if you're unsure how to do this). The tutorial.ipj file should be selected in the Getting Started dialog (see Exercise 3 in Tutorial 1 for an explanation of creating tutorial.ipj). Click "OK" to open the tutorial project. Notice that the visualization window opens in the same place you left it when you saved the tutorial file. (Remember, we didn't save the results of Tutorial 5.)

Exercise 2: Visualize a Line Plot

Let's visualize a line. Select "Line Plot" from the Visualize menu. In the dialog, select the "Y" box of the "Noisy Damped Sine 180" data item and click "OK". Insight displays a visualization of the data in the Visualization window.

Exercise 3: Perform a Curve Fitting Analysis

Now let's find a curve model that fits the Noisy Damped Sine 180 data.

1. Select the plot line in by clicking once on it.

Note Double-clicking on the line will bring up its properties dialog.

2. Select "Fit Curves" from the Analyze menu.
3. In the Fit Curves dialog you will notice that the name of the data, Noisy Damped Sine 180, already appears in the "Dependent" text field, so there's no need to browse to select data.

Note If you had visualized data with an independent (X) as well as the dependent (Y) vector, then the "Specify Independent" checkbox would have automatically been checked, and the "Independent" text field would have been filled in.

Note If you your data requires an independent (X) vector (i.e., the independent data is not a linear ramp starting at zero), then be sure to both plot using that vector, and specify it in the curve fit "Independent" text field.

4. From the "Model" droplist, select "Linear". The display to the right of the droplist shows the model's formula and depicts a representative plot.

5. Make sure the "Double Precision" Checkbox is selected. Selecting this option specifies that calculations will use double-precision floating-point numbers.

6. Make sure the "Summary" Checkbox is selected. Selecting this option opens a Summary dialog which displays fit statistics immediately after Insight has performed the fitting.

7. From the "Visualization" droplist, select "insert". A line plot of the data resulting from the Linear fit will be inserted into the line plot of the original data you selected in the Visualization window. The "Into" droplist lets you to choose to insert into given axes, or to create a new pair of axes within the same visualization. Most often you will want to let this default to the existing axes.

8. Click "Apply" to perform the operation as a trial. This option is helpful in that it allows us to try several models to determine which one gives us the best curve fit.

9. As the Analysis dialog remains open, the line plot of the data resulting from the Linear fit curve analysis is inserted into the visualization. Its default color is red. In the summary dialog, we can see how well the Linear model fits the original data by observing the Chi Square Error. The smaller the Chi Square Error (i.e., the closer it is to zero), the better the fit of the selected model to the data. Make a note of the Chi Square Error for this model and close the Summary dialog.

Exercise 4: Try Another Model

1. From the "Model" droplist, select "Cubic".

2. Click "Apply" to perform the operation on a trial basis.

Note Because the curve fitted analysis using the Linear model was done on a trial basis (by clicking "Apply"), its visualization was replaced when you applied the Cubic model.

3. The line plot of the data resulting from the Cubic fit curve analysis is inserted into the visualization. In the summary dialog, we can see how well the Cubic model fits the original data by checking the Chi Square Error. It should be closer to zero than with the Linear model. The Cubic model fits the data better.

4. Let's assume this is the kind of fit we were looking for. To give the output data a specific name, first select the "More" option. The dialog expands. The default name is displayed in the "Output" text field. We could use this name; however, let's input our own name. Click in the text field and edit so that the name appears as "Curve Fit Cubic".

5. Click "OK" to generate the new curve fitted data item which used the Cubic model.

Exercise 5: View the Data Item Generated by the Curve Fitting Process

1. Let's look at the new data item. Select "Data Manager" from the File Menu. The Data Manager window opens, displaying the data items in the project. In the row headers look for Curve Fit Cubic. Select that row by clicking on it, then choose "Attributes" from the Edit menu. Among other attributes, notice that the "Description" field has automatically been filled in with information about the curve fit. When finished, hit "Cancel" to dismiss the dialog without making changes, or "OK" to keep changes.

2. Select "Save Project" from the Visualization window's File menu to save all changes to the project file. Select "Exit" from the Visualization window's File menu to exit Insight.

Tutorial 7:
Working in the Data Manager Window

This tutorial walks you through steps for creating and working with data in the Data Manager window. Unless specified otherwise, all menu options will be selected from menus in the Data Manager window.

What You'll Learn

In this tutorial, you'll learn how to:

- View data in the Data Manager window
- Create data in the Data Manager window
- Condition data
- View and modify attributes
- View partial attributes
- View statistics

Exercise 1: Open the Tutorial Project

1. If you have not already done so, follow the steps in Tutorial 1, "Starting Insight and Opening a Project" on page 165 to generate tutorial.ipj.
2. Start Insight. (See "Start Insight and Open a Project" on page 165 if you're unsure how to do this.) The `tutorial.ipj` file should be selected in the Getting Started dialog (see Exercise 3 in Tutorial 1 for an explanation of creating `tutorial.ipj`). Click "OK" to open the tutorial project. Notice that the visualization window opens in the same place you left it when you saved the tutorial file.
3. If the Data Manager is not already open, select "Data Manager" from the File menu in the Visualization window. The Data Manager window opens.

Exercise 2: Create Data in the Data Manager

1. Let's create some array data. Select "Create Data" from the Edit menu, then select "Array". The Create Array Data dialog opens.
2. Double-click in the "Name" text field and enter "MyArray1".
3. From the "Type" droplist, select "Float" as the type of array.
4. In the first "Dimensions" text field, enter "20". In the second "Dimensions" text field, enter "60". These values specify the size of each array dimension.
5. Select "Indexed" initialization type. The elements of the created array will be set equal to their one-dimensional index numbers (the first element will be zero, the second will be one, etc.).
6. Click "OK."Insight creates the 20 x 60 element array and adds it to the Data Manager.

Exercise 3: View Data in the Data Manager

Let's view the data in the Data Manager. We *could* scroll until we find "MyArray1" which is listed in the "Names" column in alphabetical order. Instead, let's use Data Manager options to view the data in a couple of other ways.

1. First, let's view only array data. Select "Filter" from the View menu. This opens a submenu of options representing data classifications. Since our newly-created data item is a two-dimensional array, select "2D Array". In the Data Manager window, you'll see only the names and attributes of two-dimensional arrays. Your new data "MyArray1" is listed. Now select "All Attributes" from the View menu and once again all data names and attributes are listed.

2. Now, let's view data sorted by type. Simply click on the "Type" column header in the Data Manager window. Insight sorts by type. Since our newly-created data item is a "Float," scroll down to the "Float" types which are grouped together and you will find "MyArray1".

Note You also can sort by selecting "Sort" from the View menu. This opens a submenu of options representing the data attributes by which you can sort. Select the desired option. For example, if you elect to sort by name, the data items will be arranged in alphabetical order.

Exercise 4: Condition Data

Data conditioning involves simple operations which modify data items—operations such as sorting or reorganizing the number of columns and rows in an array. Let's reformat the data item: "MyArray1". Reformatting involves modifying the dimensions of a selected array without changing the total number of elements. Only the dimensions of the array are changed; the actual data remains unmodified.

1. Select the "MyArray1" data item by clicking its row.

2. Select "Reformat" from the Condition menu. The Reformat dialog opens. The dialog displays the name of the "MyArray1" data item and the size of each dimension (20 for dimension one and 60 for dimension two).

3. Click in the first "Dimensions" text field and edit. Enter a new dimension of "40". Click in the second field and enter "30". Click "OK". The resulting array has the same number of elements (1200) as the original, but is reorganized into a 40 x 30 element array.

Exercise 5: View and Modify Attributes of Data

1. Let's view the data attributes. Select the "MyArray1" data item in the Data Manager window by clicking it. Select "Attributes..." from the Edit menu. The Data Attributes Dialog opens.

   The Array Attributes dialog information for MyArray1 should be similar to the following (details are platform specific):

   Name: MyArray1

   Classification: 2D Array

   Type: Float

   Dimensions: 40, 30

Note Notice that the dimensions reflect the change you made when you reformatted the data.

Elements: 1200 (This is the product of MyArray1's dimensions.)

Size (bytes): 4800

Min, Max: 0.000000, 1199.00

Note These are the minimum and maximum values of the data. The first number is the minimum and the second number is the maximum.

Format: G0

Source: Insight Create

Description:

Modification Time: The date and time that you created the data.

2. Let's add a description. Click in the "Description" text field and enter "This data was created in a Data Manager tutorial".
3. Click "OK" to close the Attributes dialog and add the new description to MyArray1's "Description" column.

Exercise 6: View Partial Attributes and Statistics

1. Now let's limit the amount of attribute information we're viewing. Select "Partial Attributes" from the View menu. A dialog opens in which we can specify attributes we wish to view. Deselect the checkboxes to the left of all of the fields except "Name" and "Type" and click "OK". Insight displays the names and types of all data items and hides the other attribute columns from view.
2. In the Data Manager window, select "All Attributes" from the View menu to once again view all data names and attributes.
3. Now we're going to select another data item and view its statistical information. Scroll (if necessary) down to a "Float" type data item named "Domed Surface". Click the item to select it.
4. Select "Statistics" from the Edit menu. A Statistics dialog displays information about the two dimensional data named "Domed Surface". Information should be similar to the following:

Minimum: 0.486752	*the minimum value*
Maximum: 1.00000	*the maximum value*
Mean: 0.795443	*the average value of a set of values*
Mean Absolute Deviation: 0.0982436	*the sum of the absolute distance of each sample element from the population (or set of values) mean*

Median: 0.793898	*the value in an ordered set of values below and above which there is an equal number of values or which is the arithmetic mean of the two middle values if there is no one middle number*
Variance: 0.0136896	*the square of the standard deviation*
Standard Deviation: 0.117003	*the root mean square of the deviations (distances) from the population mean*
Skewness: -.0163112	*lack of symmetry*
Kurtosis: -.793014	*The peakedness or flatness of the graph of a frequency distribution especially with respect to the concentration of values near the mean as compared with the normal distribution.*

5. Click “OK” when you’re finished viewing the statistics.
6. Select “Save Project” from the Visualization window’s File menu to save these changes to the project.
7. Select “Exit” from the File menu to exit Insight.

Tutorial 8: Importing ASCII Data

This tutorial walks you through the process of importing data into Insight from a formatted ASCII text file.

What You'll Learn

In this tutorial, you'll learn how to:

- Import data from a formatted ASCII text file.

Exercise 1: Open the Tutorial Project

1. If you have not already done so, follow the steps in Tutorial 1,"Starting Insight and Opening a Project" on page 165 to generate tutorial.ipj.
2. Start Insight. (See "Start Insight and Open a Project" on page 165 if you're unsure how to do this.) The `tutorial.ipj` file should be selected in the Getting Started dialog (see Exercise 3 in Tutorial 1 for an explanation of creating `tutorial.ipj`). Click "OK" to open the tutorial project. Notice that the visualization window opens in the same place you left it when you saved the tutorial file.

Exercise 2: Import ASCII Data

The IDL distribution contains a sample ASCII data file named `ascii.dat`, located in the `data` subdirectory of the `examples` directory in the IDL distribution. We'll use Insight's ASCII file reader function to import data from this file into Insight.

1. Select "Import File As..." from the File menu of either the Visualization window or the Data Manager.
2. Use the file selection dialog to select the file `ascii.dat` from the `data` subdirectory of the `examples` directory of the IDL distribution. Click "OK".
3. The Select File Format for Import dialog appears. Click "Define and Read ASCII..." to import the ASCII data.
4. The dialog of the ASCII file reader appears. This dialog displays the first few lines of the ASCII file and allows you to specify a character that marks comments in the file. Select "Delimited" to indicate that the fields in the file are separated by a delimiter character rather than all of a specified length. Enter the "%" character in the text field next to the label "Comment String to Ignore:" — this tells Insight to discard the "%" symbol and anything that follows it on a given line. Finally, click on the first line of data in the display at the bottom of the dialog (this should be line 5) to update the "Data Starts at Line:" field. Click "Next".
5. The second page shows the form of the data to be imported. Notice that the header lines and everything after the comment character has been removed from the display. The text field labelled "Number of Fields Per Line" reports on the number of data items in each line. With the default delimiter ("Whitespace"), this field shows "4,3" for the example data file. Set the "Delimiter" field to "Tab" and notice that the number of fields per line is now simply "4" (the `ascii.dat` file is tab-delimited, and is missing one value). Click "Next".

6. The third page allows you to specify how data will be imported into Insight. The table in the upper left corner of the dialog displays the names of the fields in each record and reports the data type of each field. You can change either the name or the data type associated with a given field by selecting a field in the table and adjusting the name or field shown at the top right of the dialog.

   By default, Insight will import each record from the data file as a vector. For the example data set, this means that Insight would import four three-element vectors as separate data items. You can alter this behavior by grouping two or more fields; select all four fields in the table at the upper left and click "Group". With this configuration, Insight will import a single 4 x 3 element array rather than four vectors.

   Finally, you can control the values assigned to data elements that are "missing" from your data file. In the example data, the second element of the second record is missing. Select either "IEEE NaN" (Not-a-Number) or specify another value in the "Assign Missing Data:" field. Data elements that are not included in the ascii file will be assigned this value.

   Click "Finish" to import the data.

   Enter a file name to save the ASCII file Plugin into, or select cancel if you do not want to create the Plugin.

7. In the Data Manager, you will see a new data item named "field1". It should appear as a 2D floating-point array with dimensions 4, 3. Select "Value" from the Data Manager Edit menu, and notice that the "missing" element (at Column 1, Row 1) is shown as NaN.

8. Click "Close" to close the data view dialog and select "Exit" from the Visualization window File menu to exit Insight.

Chapter 8

Insight's IDL Interface

The following topics are covered in this chapter:

INSIGHT 189
INSGET 191
INSPUT 194
INSVIS 201

This chapter describes the Insight routines you can use to invoke and interact with Insight from the IDL command line or from within a PlugIn. You should have a working knowledge of IDL to use these routines.

Insight API routines documented in this chapter are INSIGHT, INSPUT, INSGET, and INSVIS. A description of each routine follows its name. Beneath the general descriptions are sections that specify the routine's calling sequence, its arguments, and its keywords. All keywords are optional unless specified as required.

INSIGHT

Use the INSIGHT procedure to start Insight from the IDL command line, optionally passing data into the application.

Calling Sequence

INSIGHT [, *Structure*]

or

INSIGHT [, *Var1*, ..., *Varn*]

Arguments

Structure

An IDL structure variable containing data to import into Insight. Each element of the structure will become an Insight data item. The structure may not contain objects, arrays of pointers, or substructures. The structure tag names will be used as the corresponding Insight data names.

Var1 ... Varn

One or more IDL (non-structure) variables to import into Insight. The variables cannot be objects, arrays of pointers, or structures. The variable names will be used as the corresponding Insight data names.

Keywords

IMPORT_FILE

Set this keyword equal to a string containing the name of a data file to import into the project.

Note When Insight starts, a Select Data To Import dialog opens, allowing you to select data to import. See "The Select Data To Import Dialog" on page 13.

INDEXED_COLOR

Set this keyword to start Insight in indexed-color mode. If your data uses an IDL color table *and* you are using a display device (video card) that does not support pixel depths greater than eight bits per pixel, you should start Insight with this keyword set; by default, Insight runs in true-color mode.

PLUGINS_PATH

Set this keyword to a string (or vector of strings) containing the directory (or directories) in which PlugIn files are located. Setting this keyword overrides the PlugIns path specified in the Preferences dialog. For more information on the PlugIns path, see "Preferences

Dialog: PlugIns Path" on page 25. For more information on PlugIns, see "About Insight PlugIns" on page 204 in the "Extending Insight" chapter.

PREFERENCE_FILE

Set this keyword equal to a string containing the full path name of a user preference file. If this keyword is not specified, the name and default location of the preference file depends on the type of computer you are using:

- **Unix:** The preference file is named `.insight22.prf` and is located in the your home directory.
- **VMS:** The preference file is named `insight22.prf` and is located in your home directory.
- **Windows and Macintosh:** The preference file is named `insight22.prf` and is located in the `hook` subdirectory of the `lib` directory in the IDL distribution.

If no preferences exist, Insight's default preferences are used. Insight will attempt to write a preference file when the application exits.

PROJECT_FILE

Set this keyword equal to a string containing the full path name of a project file to open. If this keyword is not specified, the Getting Started With Insight dialog opens, allowing you to select an existing project or open a new project. See "The Getting Started With Insight Dialog" on page 12.

Examples

To start Insight with default options:

```
IDL> INSIGHT
```

To start Insight in indexed color mode for an 8-bit display, passing in data from a file:

```
IDL> INSIGHT, /INDEXED_COLOR, IMPORT_FILE='/home/rob/myimage.gif'
```

To start Insight immediately on an existing project, also passing in data from the IDL command line:

```
IDL> INSIGHT, x, y, z, PROJECT_FILE='/home/rob/project.ipj'
```

INSGET

Use the INSGET function to access Insight data items from the IDL command line or from within a File or Analysis PlugIn. INSGET returns either a single variable containing the data (a scalar or an array) or a structure containing only data. However, if the PTR_OUT keyword is set, INSGET returns either a single pointer or a structure containing pointers to Insight data items. Getting pointers allows you to modify data as it exists within Insight.

Calling Sequence

Result = INSGET([*Name*])

Arguments

Name

A string or array of strings that contains the name(s) of the data item(s) to get from Insight. If *Name* is not specified, a Data Browser opens, allowing you to select data items interactively.

Keywords

COUNT

Set this keyword equal to a named variable that will contain the number of items retrieved from Insight. If the routine fails, the number of items will be zero.

DIMS_LIST

Set this keyword to a scalar or array of integers representing the dimensionality of the data to be retrieved. The value of DIMS_LIST limits which data items are retrieved or shown as being available for retrieval in the Data Browser dialog.

EXCLUSIVE

Set this keyword to limit retrieval to a single data item when a Data Browser is displayed. If EXCLUSIVE is not set, you can select multiple data items from the Data Browser dialog.

_EXTRA

Use this keyword when writing File or Analysis PlugIns.

Set this keyword equal to a named variable that will be used by Insight to pass information between a File or Analysis PlugIn and Insight itself. When Insight invokes a File PlugIn's write-procedure callback or an Analysis PlugIn's apply-function callback, it passes a structure of information in through the callback's _EXTRA keyword. Pass that structure back to Insight via INSGET's _EXTRA keyword.

See "File PlugIns" on page 206 or "Analysis PlugIns" on page 212 for details.

GROUP

Use this keyword when writing PlugIns or applications.

Set this keyword equal to the widget ID of an existing widget that serves as "group leader" for any dialogs generated by the INSGET operation.

NAME

Set this keyword equal to a named variable that will contain a string or array of strings representing the name(s) of the items obtained. (This is useful if the output is a structure. Note that Insight data item names may contain spaces, but structure tag names cannot.)

PTR_OUT

Set this keyword to indicate that the output returned should be either a single pointer or a structure containing multiple pointers to data. If this keyword is not set, INSGET returns either a single variable containing the data (a scalar or an array) or a structure containing the data.

Note If you free a pointer to the value of an Insight data item, the next time Insight tries to access that item it will be removed from the Data Manager.

RED, GREEN, BLUE

Set these keywords equal to named variables that will contain the red, green, and blue color table vectors of the first image read. You must set all three of these keywords if you set any of them. If the RED, GREEN, and BLUE keywords are not specified, the color table is not output.

TITLE

Set this keyword equal to a string to use as the title for the Data Browser dialog. If this keyword is not set, the dialog title will be "Choose Insight Data:".

Examples

To get a data item from Insight to the IDL command line:

```
IDL> myData = INSGET('My Data')
```

To browse for one or more Insight data items (if more than one item is selected, a structure will be returned):

```
IDL> sDataItems = INSGET()
```

To browse for two-dimensional data items, returning a count of the number of items returned:

```
IDL> sDataItems = INSGET(DIMS_LIST=2, COUNT=count)
```

To browse for two- and three-dimensional data items, using the given browser title, returning the associated color table (if present), and allowing only one data item to be selected:

```
IDL> image = INSGET(DIMS_LIST=[2,3], TITLE='Select an Image', $
```

IDL> RED=r, GREEN=g, BLUE=b, /EXCLUSIVE)

Dialogs

The following information relates to dialogs which may appear when using INSGET.

Project Browser

If more than one project is open, this dialog will open to let you choose which project to get data from.

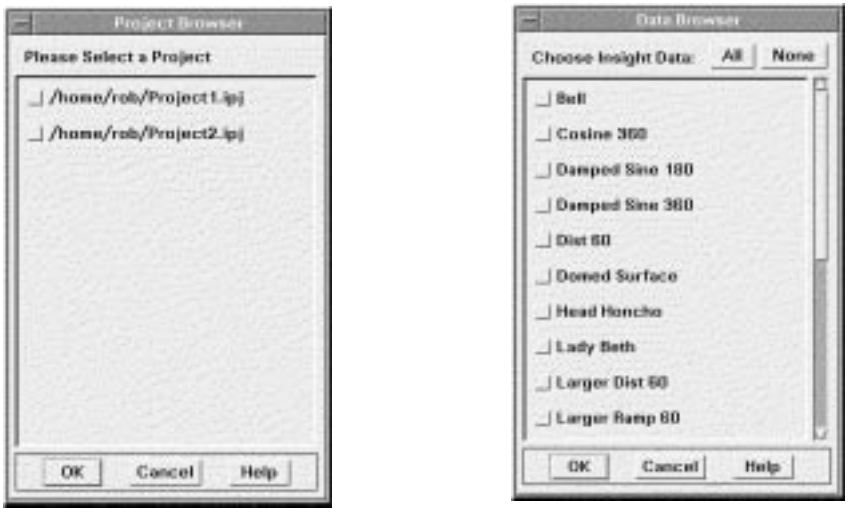


Figure 8-1: Project and Data Browser Dialogs

Data Browser

If no argument is present, this dialog will open to let you choose which data items to output.

- All - Select all data items
- None - Deselect all data items.

See Also

INSPUT

INSPUT

Use the INSPUT procedure to import IDL variables into Insight from the IDL command line or from within a File or Analysis PlugIn. If no arguments are specified, the Import IDL Variables dialog appears, allowing you to choose from a list of existing variables. Note that you can import IDL pointers, which allows you to modify data as it exists within Insight.

Calling Sequence

INSPUT [, *Structure*]

or

INSPUT [, *Var1*, ..., *Varn*]

Arguments

Structure

An IDL structure variable containing data to import into Insight. The structure may not contain objects, arrays of pointers, or substructures. The structure tag names will be used as the corresponding Insight data names.

Var1 ... Varn

One or more IDL (non-structure) variables to import into Insight. The variables cannot be objects, arrays of pointers, or structures. The variable names will be used as the corresponding Insight data names.

Keywords

CIDS

Use this keyword when writing Analysis PlugIns.

Set this keyword equal to a named variable that will contain the command IDs for Analysis PlugIns. Use this keyword if and only if calling INSPUT from within an Analysis PlugIn. Command IDs make it possible for Insight to "undo" an analysis function, removing data and visualizations that were created by an Analysis PlugIn. If this keyword is not specified, no command IDs are returned and Insight assumes you are not calling the routine from within an Analysis PlugIn.

See "Apply Function Callback" on page 213 for more on command IDs and their use.

COUNT

Set this keyword equal to a named variable that will contain the number of items put into Insight. If the routine fails, the number of items will be 0.

CT_NAME
Set this keyword equal to a string containing the name of the color table being imported into Insight (keywords RED, GREEN, BLUE, and IMAGE). See the CT_REPLACE keyword for details on how names are used.

The default is to use the name of the first data item (see keyword NAME).

CT_NEW_NAME
Set this keyword equal to a named variable that will contain a string representing the actual name assigned to the color table imported into Insight. This keyword is useful if the CT_REPLACE keyword is set to zero or two.

CT_REPLACE
Set this keyword to an integer value that determines how Insight will act when it attempts to create a color table with a name that is already in use in the Color Manager. The options are as follows:

0 - The new color table will be given a unique name.

1 - The existing color table will be replaced by a new one (i.e., the old table will be deleted and a new one created).

2 - User will be prompted for the action to take. This is the default option.

3 - The value of the existing color table will be replaced. This will cause dynamic updating to occur for any current uses, e.g., an image visualization would update to reflect the new value.

4 - (This option is present for compatibility with the REPLACE keyword. It is equivalent to option 3.)

DESCRIPTION
Set this keyword equal to a string or an array of strings containing descriptions of each data item being imported into Insight. If fewer descriptions are present than the number of data items being imported, Insight will cycle through the list of descriptions. If this keyword is not specified, descriptions will not be included with imported data items.

_EXTRA
Use this keyword when writing File or Analysis PlugIns.

Set this keyword equal to a named variable that will be used by Insight to pass information between a File or Analysis PlugIn and Insight itself. When Insight invokes a File PlugIn's read-procedure callback or an Analysis PlugIn's apply-function callback, it passes a structure of information in through the callback's _EXTRA keyword. Pass that structure back to Insight via INSPUT's _EXTRA keyword.

See "File PlugIns" on page 206 or "Analysis PlugIns" on page 212 for details.

GROUP
Use this keyword when writing PlugIns or applications.

Set this keyword equal to the widget ID of an existing widget that serves as "group leader" for any dialogs generated by the INSPUT operation.

IMAGE

Set this keyword to specify that all of the data items being imported into Insight are images. If this keyword is not set, none of the imported data items will be classified as images.

NAME

Set this keyword equal to a string or an array of strings containing the names of data items being imported into Insight. If fewer names are present than the number of data items being input, Insight will cycle through the list of names. See the REPLACE keyword for details on how names are used.

The default is to use the IDL variable name, or tag name if a structure is being input. If the data does not have a name (i.e., is an expression), a default name is automatically generated.

NEW_NAME

Set this keyword equal to a named variable that will contain a string or array strings containing the actual names assigned to data items imported into Insight. This keyword is useful if the REPLACE keyword is set equal to zero or two.

NO_DRA W

Set this keyword to inhibit the visualization window from drawing. This is useful to reduce unwanted draws and help speed the display.

RED, GREEN, BLUE

Set each of these keywords equal to a vector of byte values representing the red, green, and blue values of the color table Insight should create for input images. Note that the same color table is used for all images; the color table will be given the same name as the first imported image. The three vectors should be of the same length, and should contain between 1 and 256 values.

You must set all three of these keywords if you set any of them. If all three keywords are not set, a greyscale color table will be used.

REPLACE

Set this keyword to an integer value that determines how Insight will act when it attempts to create a data item with a name that is already in use in the Data Manager. The options are as follows:

0 - New data items will be given unique names.

1 - Existing data items will be replaced by new ones (i.e., the old items will be deleted and new ones created).

2 - User will be prompted for the action to take. This is the default option.

3 - The values of existing data items will be replaced. This will cause dynamic updating to occur for any current uses, e.g., a visualization would redraw to show the new value.

4 - Option 0 will be used for data items that do not have names (e.g., data input as an expression rather than a named variable, with no name provided via the NAME keyword), and option 3 will be used for all named inputs.

Note The prompt appears at most once per call to INSPUT, even if there are multiple data names being created.

Note If you free a pointer to the value of an Insight data item, the next time Insight tries to access that item it will be removed from the Data Manager.

Note If you import a pointer to data, destroying the corresponding data item in Insight will not free your pointer, thus maintaining the integrity of your heap variable.

Examples

To browse for IDL variables to put into Insight:

```
IDL> INSPUT
```

To input specific named variables and/or expressions into Insight:

```
IDL> INSPUT, x, y, sin(x), findgen(20)
x -> X
y -> Y
sin(x) -> Data
findgen(20) -> Data 001
```

Note The names actually used may be different than above, depending on what names are already in use in the Data Manager, and what option the user chooses on the replace dialog. See the REPLACE keyword for options.

To use specific names in a round robin fashion:

```
IDL> INSPUT, w, h, ww, hh, NAME=['Width', 'Height']
w -> Width
h -> Height
ww -> Width 001
hh -> Height 001
(...)
```

Inputting a structure:

```
IDL> INSPUT, {temperature:t, pressure:p}
-> TEMPERATURE
```

-> PRESSURE

(...)

To input images with color tables:

```
IDL> INSPUT, image1, image2, red=r, green=g, blue=b, /IMAGE
```

To input images and a color table:

```
IDL> INSPUT, image1, image2, RED=r, GREEN=g, BLUE=b, /IMAGE
```

To input an image and color table, using some of the advanced data and color table naming and replacement options (the data item will be given a unique name, returned as nameUsed; the color table will be called "Super Colormap", replacing the values of any existing color table of that name):

```
IDL> INSPUT, myImage, /IMAGE, REPLACE=0, NEW_NAME=nameUsed, $
IDL> RED=r, GREEN=g, BLUE=b, $
IDL> CT_NAME='Super Colormap', CT_REPLACE=3
```

Dialogs

The following information relates to dialogs which may appear when using INSPUT.

Project Browser

If more than one project is open, this dialog will open to let you choose which project to input into.

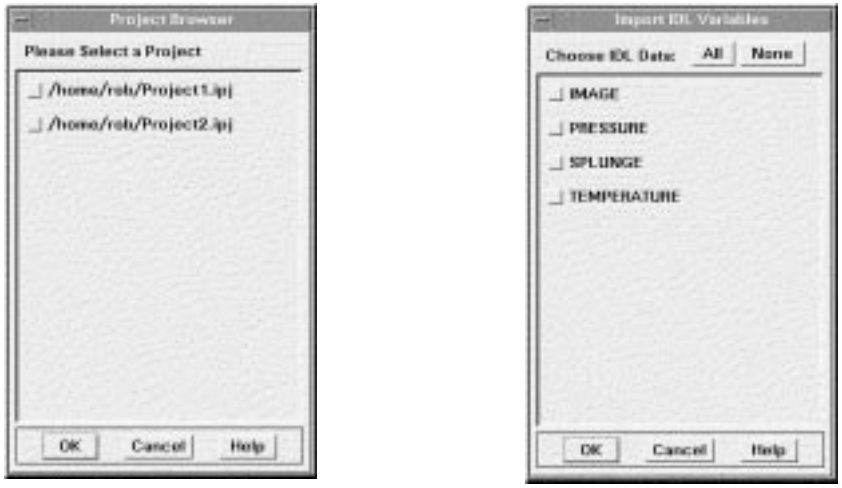


Figure 8-2: Project Browser and Import IDL Variable Dia

Import IDL Variables

If no arguments are specified, this dialog will open to let you choose which variables to input into Insight.

- All - Select all variables
- None - Deselect all variables; Duplicate Data Name

Duplicate Data Name

If duplicate data names exist, this dialog will appear. Select the appropriate option for the data name.

- Replace the Data Item's Value - Replaces the *value* of an existing data item of the same name. This will result in dynamic updating of any current uses of that item, where possible. For example, a visualization would automatically attempt to redraw using the new value.
- Replace the Data Item - Replaces the data item, i.e., the old data item will be deleted and a new one will be created. Future use of the old item will no longer be possible (e.g., if an old item was being visualized, you would loose the ability to edit its properties).
- Use Unique Name "XYZ" - The unique (unused) name will be given to the new data item.

Duplicate Color Table Name

- Replace the Color Table's Value - The existing color table will be replaced by a new one (i.e., the old table will be deleted and a new one created).
- Replace Color Table - The value of the existing color table will be replaced. This will cause dynamic updating to occur for any current uses, e.g., an image visualization would update to reflect the new value.
- Use Unique Name "XYZ" - The unique (unused) name displayed will be given to the new color table.

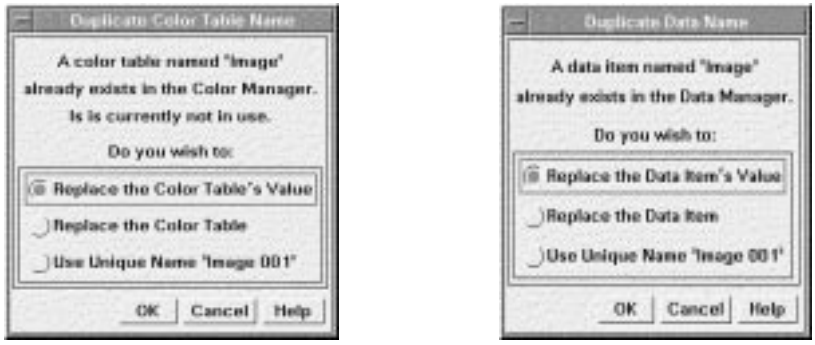


Figure 8-3: Duplicate Color Table Name and Duplicate Data Name Dialogs

See Also

INSGET

INSVIS

Use the INSVIS procedure to create or insert into an Insight visualization from within an Analysis PlugIn. You cannot use the INSVIS procedure directly from the IDL command prompt.

Calling Sequence

INSVIS, *Name1* [, *Name2, Name3*]

Arguments

Name1

A string containing the name of the data item, usually the dependent (Y) data. (For polar plots, this is the radius data.)

Name2

A string containing the name of an optional data item, usually the independent (X) data. (For polar plots, this is the angle data.) This argument is not valid for image visualizations.

Name3

A string containing the name of an optional data item to visualize, usually the independent (Y) data. This argument is only valid for contour and surface visualizations.

Keywords

CIDS

You must specify this keyword.

Set this keyword equal to a named variable that will contain the command IDs. Command IDs make it possible for Insight to "undo" an analysis function, removing data and visualizations that were created by an Analysis PlugIn.

See "Apply Function Callback" on page 213 for more on command IDs and their use.

_EXTRA

You must specify this keyword.

Set this keyword equal to a named variable that will be used by Insight to pass information between an Analysis PlugIn and Insight itself. When Insight invokes an Analysis PlugIn's apply-function callback, it passes a structure of information in through the callback's _EXTRA keyword. Pass that structure back to Insight via INSPUT's _EXTRA keyword.

See "Analysis PlugIns" on page 212 for details.

GROUP

Set this keyword equal to the widget ID of an existing widget that serves as "group leader" for any dialogs generated by the INSVIS operation.

MODE

Set this keyword equal to a string specifying the visualization mode. Valid string values are 'new' (create a new visualization), 'insert' (insert into the currently selected visualization), or 'none' (do not visualize; INSVIS simply returns). The default mode is 'new'.

Note 'Insert' mode is only available when the TYPE keyword is set equal to 'plot'.

TYPE

Set this keyword equal to a string specifying the visualization type. Valid string values are 'plot', 'scatter', 'histogram', 'polar', 'image', 'contour' and 'surface'. The default type is 'plot'.

Note Visualizations of type 'plot', 'scatter', and 'histogram' may be inserted into each other; those of type 'polar' may be only be inserted into other 'polar' visualizations.

XRANGE

Set this keyword to a two-element vector specifying the minimum and maximum X values when the MODE keyword is not set equal to 'insert' and the TYPE keyword is set equal to 'plot', 'scatter', 'histogram', or 'polar'. If XRANGE is not specified, Insight uses the minimum and maximum X values of the data item.

YRANGE

Set this keyword to a two-element vector specifying the minimum and maximum Y values when the MODE keyword is not set equal to 'insert' and the TYPE keyword is set equal to 'plot', 'scatter', 'histogram', or 'polar'. If YRANGE is not specified, Insight uses the minimum and maximum Y values of the data item.

Chapter 9

Extending Insight

The following topics are covered in this chapter:

About Insight PlugIns..... 204
General Guidelines for Writing PlugIns 205
File PlugIns..... 206
Conditioning PlugIns 210
Analysis PlugIns..... 212

This chapter describes how you can add functionality to Insight by creating PlugIns. Detailed knowledge of Insight's underlying code architecture is not required to build a PlugIn; however, PlugIn authors must:

- have a working knowledge of IDL, and
- follow the Insight PlugIn development guidelines described in this chapter.

Insight PlugIns use routines which are described in Chapter 8, "Insight's IDL Interface".

About Insight PlugIns

A PlugIn is a set of routines written in the IDL language and stored in an IDL `.pro` file. PlugIns must follow Insight's PlugIn conventions as described in this chapter. The three types of Insight PlugIns are:

- File (see "File PlugIns" on page 206)
- Conditioning (see "Conditioning PlugIns" on page 210)
- Analysis (see "Analysis PlugIns" on page 212)

Installing PlugIns

Installing a PlugIn into Insight requires little more than putting the IDL `.pro` file containing the PlugIn code in a directory and telling Insight where to search. The steps are:

1. Select "Preferences" from the File Menu in the Visualization window. The Preferences dialog opens.
2. Select "PlugIns Customization" from the "Category" droplist to specify the directory where PlugIns will be placed. The PlugIns Customization dialog options appear.

Caution All of the `.pro` and `.sav` files in the PlugIns path must be PlugIns.

If you have modified the Plugins path, Insight will de-install any existing PlugIns and search the path for new PlugIns. If any PlugIns are found, Insight installs them immediately. Insight also will search the path saved in the Preferences dialog for PlugIns the next time you start Insight.

The PlugIns path saved in preferences may be overridden by the PLUGINS_PATH keyword to INSIGHT.

Note Any time during a session you can modify and compile an existing PlugIn file to use its new functionality. Just make sure you don't modify the PlugIn's registration routine; for example, the callback names must remain the same.

Removing PlugIns

To remove a PlugIn from Insight, simply remove it from the PlugIns directory. The next time you start Insight, the PlugIn will not be available.

General Guidelines for Writing PlugIns

Detailed rules for writing each of the three types of Insight PlugIns are included below. The following are some general rules that apply to any Insight PlugIn.

PlugIn Format

PlugIns consist of IDL code, and are contained in standard IDL `.pro` or `.sav` files. Each PlugIn consists of one or more IDL *callback routines* that do some work on your data, *general routines* that perform tasks associated with the PlugIn's function, if necessary, and a *registration routine*. The registration routine is always the last routine in the PlugIn's `.pro` file.

Callback Routines

Callback routines perform the work of the PlugIn: importing or exporting data, conditioning data, or performing some type of analysis on data. Each PlugIn has at least one callback routine.

General Routines

General routines perform support functions for the PlugIn: handling widget events if there is a widget application associated with the PlugIn, creating widgets, etc.

Registration Routine

Every Insight PlugIn has a registration routine. The registration routine makes Insight aware of your PlugIn; it reports the type of PlugIn and the names of the associated routines, along with other pertinent information. The registration routine must always be the last routine in the PlugIn's `.pro` file.

Storing PlugIns as `.sav` Files

When you start Insight in runtime mode (by double-clicking on the Insight icon in Windows), PlugIns stored in `.pro` files are not loaded. You can, however, store PlugIns in `.sav` files; in this case, the PlugIns will be loaded when Insight starts in runtime mode.

To store your PlugIn as a .sav file, do the following:

1. Exit and restart IDL. This clears IDL's memory of all compiled routines.
2. Compile the PlugIn routines in the normal way. For example, if your PlugIn is named `MyPlugin`, you could enter

   .COMPILE MyPlugin

   at the IDL command prompt.
3. Create an IDL save file with the following command:

   SAVE, /ROUTINES, FILE='*PlugIn_name*.sav'

   where *PlugIn_name* is the name of your PlugIn.
4. Move the `.sav` file to the PlugIns directory.

Note You will need to exit and restart IDL for each PlugIn you compile into a `.sav` file. Also, if your normal IDL startup procedure includes compilation of any of your own routines, you should disable those parts of the startup when compiling `.sav` files. The point is to ensure that only the PlugIn routines are compiled in IDL's memory when you issue the SAVE command.

Note You may need to re-save your PlugIn routines when an upgraded version of Insight is released. Keep an archive of your source (`.pro`) files.

File PlugIns

File PlugIns read and/or write custom data file formats into and out of Insight. For example, you can create a PlugIn to import and export files stored in a proprietary image data format. Basically, File PlugIns add file formats to the list of formats Insight recognizes when you are importing and exporting data files.

Note File formats recognized by Insight are listed in the Select File Format dialogs, which open whenever Insight prompts you to designate a format for a file you're trying to import or export. If you try to import or export a file type which does not appear in Insight's internal list of "known" formats, or if there is more than one way to import or export files of the specified type, Insight will prompt you with a Select File Format dialog. For example, if you add a File PlugIn to import and export bitmap files (files with a .bmp extension), Insight will ask you to select the proper import or export procedure.

Required Routines

File PlugIns require at least the following routines:

- A Read procedure callback and/or a Write procedure callback.
- A Registration function.

Example PlugIns

A working File PlugIn named MyPPM is included in the IDL distribution. Look at the file `myppm.pro` in the `plugins` subdirectory of the `insight` subdirectory of the `examples` directory in the IDL distribution.

Read Procedure Callback

A Read procedure reads a specified file from the computer's file system. When a user selects "Import File" or "Import File As..." from an Insight menu and imports a file using a File PlugIn, the PlugIn's Read procedure reads the file and then invokes the INSPUT procedure to insert the data into Insight.

A Read procedure must be structured as follows:

Procedure Name

By convention, read procedures are named `READ`*`plugin`* where *plugin* is the name of the File PlugIn the read procedure belongs to. For example, if the name of your file PlugIn is "MyPPM" then the name of the read procedure would be `READMyPPM`.

Arguments to the Read Procedure

Read procedures should accept two arguments: the name of the file to be read and a named variable that will contain the data name created by Insight. (You can change the data name if you wish.)

Keywords to the Read Procedure

Read procedures should accept the following keywords:

_EXTRA

Set this keyword equal to a named variable that will contain a structure of information provided by Insight. You will pass this information back to Insight by specifying the _EXTRA keyword in your PlugIn's call to INSPUT.

You must specify this keyword when creating your Read procedure.

GROUP

Set this keyword equal to a named variable that will contain the widget ID of the widget base over which Insight will center any dialogs associated with this routine. Pass this variable to the INSPUT routine via its GROUP keyword.

TAIL

Set this keyword equal to the base filename (that is, the file name and extension, without any directory information) of the file to be read. This keyword is optional.

Example Read Procedure

A PlugIn Read procedure definition should look something like this:

```
pro READplugin, filename, name, GROUP=group, TAIL=tail, _EXTRA=extra
   IDL statements to read a file
   Call to INSPUT to insert the data into Insight
END
```

Write Procedure Callback

A Write procedure writes a specified file to the computer's file system. When a user selects "Export File" or "Export File As..." from an Insight menu and exports a file using a File PlugIn, the PlugIn's Write procedure invokes the INSGET procedure to retrieve data from Insight and then writes the file.

A Write procedure must be structured as follows:

Procedure Name

By convention, write procedures are named `WRITE`*`plugin`* where *plugin* is the name of the File PlugIn the write procedure belongs to. For example, if the name of your file PlugIn is “MyPPM” then the name of the read procedure would be `WRITEMyPPM`.

Arguments to the Write Procedure

Write procedures should accept two arguments: the name of the file to be written and the name of the data item to write to a file.

Keywords to the Write Procedure

Write procedures should accept the following keywords:

_EXTRA

Set this keyword equal to a named variable that will contain a structure of information provided by Insight. You will pass this information back to Insight by specifying the _EXTRA keyword in your PlugIn’s call to INSGET.

You must specify this keyword when creating your Write procedure.

GROUP

Set this keyword equal to a named variable that will contain the widget ID of the widget base over which Insight will center any dialogs associated with this routine. Pass this variable to the INSPUT routine via its GROUP keyword.

TAIL

Set this keyword equal to the base filename (that is, the file name and extension, without any path information) of the file to be written. This keyword is optional.

Example Write Procedure

A PlugIn Write procedure definition should look something like this:

```
pro WRITEplugin, filename, name, GROUP=group, TAIL=tail, _EXTRA=extra
   Call to INSGET to retrieve the data from Insight
   IDL statements to write a file
END
```

Registration Function

The Registration function is invoked when a PlugIn is registered. PlugIn registration occurs when Insight is started or when you change the PlugIns directory in the Preferences dialog. The registration process makes Insight “aware” of the PlugIn and its associated callback routines.

The Registration function must be the last routine in the PlugIn file. The name of the Registration function must match the name of the PlugIn file (not including the extension). For example, if your file is named `myppm.pro`, the Registration function must be named `myppm`. The name of the Registration Function must be unique. Do not

create different PlugIns with the same name or use the name of an existing IDL routine. The Registration function should return a structure with the following fields:

type	the string 'File_PlugIn'.
title	a string specifying the title of the PlugIn.
purpose	a string containing a brief sentence which specifies the purpose of the PlugIn.
read_proc	a string specifying the name of the callback that reads data; see “Read Procedure Callback” on page 206. If there is no read procedure, specify an empty string.
write_proc	a string specifying the name of the callback that writes data; see “Write Procedure Callback” on page 207. If there is no write procedure, specify an empty string.
file_ext	a string or array of strings specifying the file extension(s) to be used when importing and exporting. Do not include the period. For example, the string for a PPM file format should be 'ppm' rather than '.ppm'.
version	a string specifying the version of IDL for which the PlugIn is written.
revision	the string '1.0'.

Example Registration Function

The following is the registration function from the MyPPM PlugIn, included in `plugins` subdirectory of the `insight` subdirectory of the `examples` directory in the IDL distribution:

```
FUNCTION MyPPM
  RETURN, { $
    type:        'File_PlugIn', $
    title:       'My PPM/PGM Format', $
    purpose:     'Handle PPM/PGM files.', $
    read_proc:   'ReadMyPPM', $
    write_proc:  'WriteMyPPM', $
    file_ext:    ['ppm','pgm'], $
    version:     '5.1', $
    revision:    '1.0' $
  }
END           ; MyPPM
```

Conditioning PlugIns

A *Conditioning PlugIn* performs a mathematical operation on an Insight data item selected in the Data Manager window. For example, you can write a Conditioning PlugIn that rotates a data item by 90 degrees. Insight includes Conditioning PlugIns in a submenu of the "PlugIns..." option of the Condition menu in the Data Manager window.

Conditioning PlugIns do not get data from Insight, add data to Insight, or visualize data, so they never use Insight API procedures.

Required Routines

Conditioning PlugIns require the following routines:

- One or more event handling routines (if necessary)
- A Main function callback
- A Registration function

Example PlugIns

A working Conditioning PlugIn named MyNegate is included in the IDL distribution. MyNegate uses a widget interface to solicit user input. Look at the file `mynegate.pro` in the `plugins` subdirectory of the `insight` subdirectory of the `examples` directory in the IDL distribution.

A Conditioning PlugIn named MyAbs is also included in the distribution. MyAbs does not use a widget interface.

Event Handling Routines

If your PlugIn includes an IDL widget user interface, write an event handling routine or routines to handle events and perform your PlugIn operation. Be sure to catch and handle your own errors.

Main Function Callback

The Main function callback is invoked when the menu option is selected and returns an integer value reporting success or failure of the operation. The Main function creates the dialog (if any) associated with the conditioning PlugIn and starts the event loop. Make sure that any dialog you create to handle user input has the MODAL keyword set on its top-level widget base.

The Main function must be structured as follows:

Function Name

By convention, the Main functions are named `PromptUser`*`plugin`* if the PlugIn uses a graphical user interface, or `Do`*`plugin`* if it does not, where *plugin* is the name of the Conditioning PlugIn the Main function belongs to.

Return Value

The Main function must return either one (success) or zero (failure).

Arguments to the Main Function

The Main function should accept one argument: a named variable that will contain the data to be conditioned.

Keywords to the Main Function

_EXTRA

Set this keyword equal to a named variable that will contain a structure of information provided by Insight.

GROUP

Set this keyword equal to a named variable that will contain the widget ID of the widget base over which Insight will center any dialogs associated with this routine. Be sure to pass this variable to the WIDGET_BASE function via the GROUP_LEADER keyword.

Example Main Function

A Conditioning PlugIn Main function definition should look something like this:

```
FUNCTION PromptUserplugin, data, GROUP=group, _EXTRA=extra
   IDL statements to create dialog
   Call to XMANAGER to register the widgets
   RETURN, returnvalue
END
```

Registration Function

The Registration function is invoked when a PlugIn is registered. PlugIn registration occurs when Insight is started or when you change the PlugIns directory in the Preferences dialog.

The registration process makes Insight “aware” of the PlugIn and its associated callback routines, and adds menu items representing the PlugIn to the “PlugIns” option of the Conditioning menu.

The Registration function must be the last routine in the PlugIn file. The name of the Registration function must match the name of the PlugIn file (not including the extension). For example, if your file is named `mynegate.pro`, the Registration function must be named `mynegate`.

The name of the Registration Function must be unique. Do not create different PlugIns with the same name or use the name of an existing IDL routine. The Registration function should return a structure with the following fields:

type	the string 'Conditioning_PlugIn'.
title	a string specifying the title of the PlugIn, to be used in Insight menus.
purpose	a string containing a brief sentence which specifies the purpose of the PlugIn.
main_func	a string specifying the name of the main function callback.
version	a string specifying the version of IDL for which the PlugIn is written.
revision	the string '1.0'.

Example Registration Function

The following is the registration function from the MyNegate PlugIn, included in `plugins` subdirectory of the `insight` subdirectory of the `examples` directory in the IDL distribution:

```
FUNCTION MyNegate
  RETURN, { $
    type:        'Conditioning_PlugIn', $
    title:       'My Negate...', $
    purpose:     'Reverse the sign of data.', $
    main_func:   'PromptUserMyNegate', $
    version:     '5.1', $
    revision:    '1.0' $
  }
END           ; MyNegate
```

Analysis PlugIns

Analysis PlugIns perform potentially complex mathematical operations involving one or more Insight data items. For example, you can write an Analysis PlugIn that solves linear equations and visualizes the result. Insight includes Analysis PlugIns in a submenu accessed when you select the “PlugIns...” option of the Analyze menu in the Visualization window.

Analysis PlugIns use the INSPUT, INSGET, and INSVIS routines to import, export, and visualize data.

Required Routines

Analysis PlugIns require the following routines:

- One or more event handling routines (if necessary)
- An Apply function callback
- A Main procedure callback (if necessary)
- A Registration function

Example PlugIns

A working Analysis PlugIn named MyBias is included in the IDL distribution. MyBias uses a widget interface to solicit user input. Look at the file `mybias.pro` in the `plugins` subdirectory of the `insight` subdirectory of the `examples` directory in the IDL distribution.

An Analysis PlugIn named MyBias0 is also included in the distribution. MyBias0 does not use a widget interface.

Event Handling Routines

If your PlugIn includes an IDL widget user interface, write an event handling routine or routines to handle events and perform your PlugIn operation. Be sure to catch and handle your own errors.

Apply Function Callback

If your PlugIn includes an IDL widget user interface, the Apply function is invoked when the user selects “OK” or “Apply” in a PlugIn dialog. If your PlugIn does not include a widget interface, the Apply function is called immediately when the user selects the PlugIn from the Analysis menu. This function performs the main operation of the Analysis PlugIn and returns a success flag. The Apply Function can use INSGET to get data from the Insight data area; INSPUT to put data into the Insight data area; and INSVIS to visualize data.

The Apply function must be structured as follows:

Function Name

By convention, the Apply function is named `APPLY`*`plugin`* where *plugin* is the name of the Analysis PlugIn the apply function belongs to.

Return Value

The Apply function must return either the integer one (success) or zero (failure).

Arguments to the Apply Function

The Apply function should not accept any arguments.

Keywords to the Apply Function

_EXTRA
Set this keyword equal to a named variable that will contain a structure of information provided by Insight. You will pass this information back to Insight by specifying the _EXTRA keyword in your PlugIn's call to INSGET, INSPUT, or INSVIS.

You must specify this keyword when creating your Apply function.

CIDS
Set this keyword equal to a named variable that will contain the Command IDs. A Command ID (CID) is information returned in a variable specified via the CIDS keyword to INSPUT or INSVIS. The CID list allows Insight to support "Undo" and "Redo" functionality for your PlugIn.

You must specify this keyword when creating your Apply function.

DATA_NAME
Set this keyword equal to a named variable that will contain the name of the data selected in the Visualization window. The variable specified by DATA_NAME will contain an empty string (' ') if no data element is selected.

Main Procedure Callback

If your PlugIn includes an IDL widget user interface, the Main Procedure Callback is invoked when the user selects your PlugIn from the Analysis menu. This procedure creates the dialog and starts the event loop. Make sure that any dialog you create to handle user input has the MODAL keyword set on its top-level widget base.

The Main procedure must be structured as follows:

Procedure Name

By convention, the Main procedure function should be named `PromptUser`*`plugin`* where *plugin* is the name of the Analysis PlugIn the Main procedure belongs to.

Arguments to the Main Procedure

The Main procedure should not accept any arguments.

Keywords to the Main Procedure

_EXTRA
Set this keyword equal to a named variable that will contain a structure of information provided by Insight. You will pass this information back to Insight by specifying the _EXTRA keyword in your PlugIn's call to CW_INSAPPLY.

You must specify this keyword when creating your Apply function.

GROUP

Set this keyword equal to a named variable that will contain the widget ID of the widget base over which Insight will center any dialogs associated with this routine. Be sure to pass this variable to the WIDGET_BASE function via the GROUP_LEADER keyword.

DATA_NAME

Set this keyword equal to a named variable that will contain the name of the data selected in the Visualization window. The variable specified by DATA_NAME will contain an empty string (' ') if no data element is selected.

OK, Apply, and Cancel Buttons

Insight provides a special compound widget to create the OK/Apply/Cancel buttons for Analysis PlugIns. Use the `CW_INSAPPLY()` function to create the buttons on your Analysis PlugIn's main base:

```
result = CW_INSAPPLY(base, _EXTRA=extra)
```

where *base* is the widget ID of you modal top-level widget base, and *extra* the named variable specified via the _EXTRA keyword to the Main procedure.

Registration Function

The Registration function is invoked when a PlugIn is registered. PlugIn registration occurs when Insight is started or when you change the PlugIns directory in the Preferences dialog. The registration process makes Insight "aware" of the PlugIn and its associated callback routines, and adds menu items representing the PlugIn to the "PlugIns" option of the Analyze menu of the Visualization window.

The Registration function must be the last routine in the PlugIn file. The name of the Registration function must match the name of the PlugIn file (not including the extension). For example, if your file is named `mybias.pro`, the Registration function must be named `mybias`. The name of the Registration Function must be unique. Do not create different PlugIns with the same name or use the name of an existing IDL routine. The Registration function should return a structure with the following fields:

type	the string 'Analysis_PlugIn'.
title	a string specifying the title of the PlugIn, to be used in Insight menus.
purpose	a string containing a brief sentence which specifies the purpose of the PlugIn.
main_proc	a string specifying the name of the Main procedure callback. If there is no Main procedure, specify an empty string.
apply_func	a string specifying the name of the Apply function callback.
version	a string specifying the version of IDL for which the PlugIn is written.
revision	the string '1.0'.

Example Registration Function

The following is the registration function from the MyBias PlugIn, included in `plugins` subdirectory of the `insight` subdirectory of the `examples` directory in the IDL distribution:

```
FUNCTION MyBias
  RETURN, { $
    type:        'Analysis_PlugIn', $
    title:       'My Bias...', $
    purpose:     'Do simple biasing.', $
    main_proc:   'PromptUserMyBias', $
    apply_func:  'ApplyMyBias', $
    version:     '5.1', $
    revision:    '1.0' $
  }
END           ; MyBias
```

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(The following are curve fitting (cf) equations in order, numered inst1001-16)

The following are for the formulator

The following are misc. data browsers

Following are for INSPUT/INSGET dialogs

The Organizer and Clipboard

Scalar/Array Value

Miscellaneous

Insight incorporates many of IDL's analysis capabilities. As you work on technical problem solving, use options from the Analyze menu to analyze data, visualize analysis results, and generate new data. Most of the time, you need only select the desired menu and dialog options. Insight performs the coding "underneath" to perform analyses and generate new data based on your dialog selections.

A Fourier transform is a method of "transforming" an image from the spatial to the frequency domain in order to perform frequency analysis.

The Summary dialog for Fit Curve analysis displays results immediately after you have performed an analysis using a Fit Curve dialog. The following information appears:

Model (selected in the dialog)

Equation (for the model selected)

Parameters (Insight computes the parameters of the selected model based on the data selected in the dialog.)

Chi Square Error (Indicates how well the selected model fits the data. The smaller the Chi Square Error (i.e. the closer it is to absolute zero), the better the fit of the selected model to the data.)

Relative Maximum Deviation (This value represents the maximum point at which the model differs from data. If the individual points that make up the data fit the model with a high degree of accuracy, the Relative Maximum Deviation is close to "0". A Relative Maximum Deviation value closer to "1" indicates that there may be a hidden (or "bad") value in the data that deviates.)

Insight is an application for analyzing, visualizing, and working with data in a variety of ways. With Insight you have the advantages of IDL's computing environment – powerful, array-oriented language, mathematical analysis, and graphical display techniques – without having to know the underlying IDL language.

The term "visualization" refers to the display of data in the Visualization window. Data displayed (or "visualized") in the Visualization window are referred to in this documentation as *visualizations*. You can display several types of visualizations: images, line plots, scatter plots, histogram plots, polar plots, contours, and surfaces. Individual graphical items, called *elements* in this documentation, comprise a visualization. Elements include axes, plot lines, annotations, etc.

When you start the Insight application and open a new or existing Insight project, one of the project components, the Visualization window, appears on your screen as a viewing area with a menubar and toolbar. The Visualization window is:

- the primary workspace in which you can visualize data,
- the hub from which you can navigate to analysis dialogs, the Data Manager window, and other Insight projects,
- the window in which you save changes to the project, open additional projects, close the current project, and exit Insight.

An Insight *project* is a group of related components which are used together. A single Insight project contains various types of information, including the configuration of a visualization window; a data area, styles, color tables, etc. You manage, save, and store multiple Insight components together as a project, in a file with an ".ipj" extension.

The Visualization toolbar features buttons corresponding to various Visualization menu and annotation options. When a menu option is disabled, the corresponding toolbar button is disabled as well. The toolbar is located across the top of the Visualization window below the menubar. When you move the mouse over each button, the name of the button appears in the lower left-hand corner of the Visualization window.

The Data Manager window is your view of the Insight data area associated with the Insight project. The Data Manager contains a list of data items with specific information about each, called attributes. To open the Data Manager window, select the "Data Manager" option from the File Menu in the Visualization window. As a shortcut, you can click the "Data Manager" button in the Visualization Toolbar.

"Extending Insight" means adding functionality by creating Insight PlugIns. Detailed knowledge of Insight's underlying code architecture is not required to build a PlugIn; however, PlugIn authors must have a working knowledge of IDL and follow the Insight PlugIn development guidelines described in Chapter 9.

Annotations allow you to label and illustrate visualizations displayed the Visualization window. Select the desired Annotation button in the Visualization toolbar ("Line," "Rectangle," or "Text") located on the right-hand side of the toolbar.

Insight organizes the information describing data as a set of attributes. Examples of attributes are name, classification, type, dimensions, elements, description, value, modification time, minimum value, and maximum value.

Data files can contain data in many different formats. Data files may contain any type of data (integer, real, complex, string, etc.) and can be formatted in many different ways (tiff, gif, pict, etc.). Once a data file has been read, its contents (the data) are included in Insight as data items.

The template project is the Insight project file on which all "new" projects are based. The template is named "insightxx.ipj" (or ".insightxx.ipj for Unix) where "xx" is the version number of Insight (e.g., insight20.ipj). When you open a new project, it will contain the graph styles, color tables, data, and visualizations that are included in that template project.

Insight's example projects are installed along with IDL. The example projects contain data, visualizations, and styles for you to inspect and use.

The data-independent properties of a selected visualization saved together as a named style. You can create and apply styles to visualizations.

Each data file has a certain format. If Insight does not recognize the format of data you're trying to import or export, a Select File Format dialog appears with a list of formats from which to choose.

Insight allows you to set preferences for customizing general application features and menu display and specifying PlugIns and Preferences directories.

An advanced data “calculator” which gives you the power to create formulas, expressions, and data items at the click of the mouse button. While you use Insight, you can keep the formulator open and “at your fingertips.”

Data conditioning involves simple operations which modify data. You can use the Data Manager Window’s Condition menu options to reformat, resize, reverse, sample, sort, and transpose data. Note that new data items or visualizations are not created when you condition a data item.

A single-number variable

Data with up to eight dimensions

Unsigned integers from 0 to 255

Integers from -32768 to +32768

Integers from -231 to 231-1

Single precision, floating-point with six significant places. Magnitudes range from 10-38 to 1038 on machines with IEEE arithmetic or 10-34 on VAX systems.

Floating point with approximately sixteen decimal digits.

A real, imaginary pair of floating-point numbers.

A real, imaginary pair of double-precision floating-point numbers.

A sequence of 0 to 32,767 characters.

Fields are aligned in columns.

Separators (such as commas or white space) that “separate” each field.

Statistical information about the selected data. The Insight Statistics Dialog displays the following:

Minimum: the minimum value of the data

Maximum: the maximum value of the data

Mean: the average value of a set

Mean Absolute Deviation: the sum of the absolute distance of each sample element from the population (or set of values) mean.

Median: the value in an ordered set of values below and above which there is an equal number of values or which is the arithmetic mean of the two middle values if there is no one middle number

Variance: the square of the standard deviation

Standard Deviation: the root mean square of the deviations (distances) from the population mean.

Skewness: lack of symmetry

Kurtosis: The peakedness or flatness of the graph of a frequency distribution especially with respect to the concentration of values near the mean as compared with the normal distribution.

An *element* is the most basic graphical item displayed by Insight. Elements include axes, plot lines, annotations, etc. One or more graphic elements comprise a visualization.

Properties are characteristics of a visualization that determine how it looks. Insight provides many ways to customize visualizations. Select the Properties option of the Edit menu to open a Properties dialog that allows you to inspect and modify the unique properties of a selected visualization or element. Examples of visualization properties are X and Y locations and background color. Examples of element properties are line type, line color, and symbol.

A Data Browser contains a scrolling list of data items from which to choose. Select an item by clicking the box to its left (or follow specific selection instructions in the dialog or documentation.) When you are finished, click “OK.”

Image Processing

Image processing uses various methods to filter and transform image data. An image consists of a two-dimensional array of pixels. The value of each pixel represents the intensity and/or color of that position in the scene. Images of this form are known as sampled or raster images because they consist of a discrete grid of samples. Such images come from many sources and are a common form of representing scientific and medical data.

Smoothing softens edges or compensates for random noise. You can smooth data of any number of dimensions with a boxcar average of a specified width. For more detail see “SMOOTH” in the *IDL Reference Guide*.

Use curve fitting analysis to find an analytic representation (or Model) which represents data compactly. Typically, your data is already plotted in the Visualization window. Using Insight’s Fit Curve dialog, you can scroll through a list of models to find the best representation of your data.

A curve is a plot of points on the x and y axes; y is called a function of x. The data points are also known as a vector.

Artifact

Artifact is errant data values typically caused by instrumentation or other collection device error.

Correlation involves quantifying the “likeness” or “degree to fit” of one or more sample populations to an ideal linear model or to other sample populations. The measure of likeness may be based upon the actual data values or upon their magnitude-based ranks.

Based on criteria you specify in the Correlate dialog, Insight automatically computes the correlation and opens a window showing the correlation value. For example, an output value of 1 indicates a perfect positive linear correlation; an output value of -1 indicates a perfect negative linear correlation; an output value of -0.98 indicates a high negative linear correlation; and an output value close to zero indicates a poor linear correlation.

A “tiling scheme” is a grid in the Visualization window containing a specific number of places for visualizations. This is helpful if you wish to visualize more than one data item simultaneously. For example, if you plan to view three visualizations simultaneously displayed in one row, select the “1 By 3” (Rows By Columns) option from the View menu. Insight displays data items from left to right and from bottom row to top row.

An image is often understood as a picture, but actually any two-dimensional data item can be displayed as an image. A two-dimensional array is interpreted as an array of pixels, in which the value of each pixel represents the intensity and/or color of that element.

A PlugIn is a routine written in the IDL language. PlugIns must follow Insight’s PlugIn conventions, as described in Chapter 9. PlugIns extend the built-in functionality provided by Insight. The three types of Insight PlugIns are File, Conditioning, and Analysis.

File PlugIns read and write custom data file formats into and from Insight.

Conditioning PlugIns perform mathematical operations on Insight data selected in the Data Manager window.

Analysis PlugIns can perform potentially complex mathematical operations involving one or more Insight data items.

Using Insight API routines, you can extend Insight from the command line or from within a PlugIn. Insight’s API Procedures are INSIGHT, INSPUT, INSGET, and INSVIS.

Displays results immediately after Insight has completed all Fit Curve analyses and some Correlation analyses.

The Visualization Manager lists each visualization in the window. Using the Visualization Manager, you easily can select and edit or delete elements or entire visualizations. Each visualization name is followed by a list of its elements. If you select an item in the Visualization window, that item’s name is highlighted when you open the Visualization Manager. When you select a name in the Visualization Manager, that item is selected in the Visualization window.

```
nstopic AboutThisManual insover:0100 "Overview" 1
topicmacro CIB(chapter,PI("","nav_insover")) 1
endnonscroll 1
nstopic ins_about insover:0110 "About Insight" 1
endnonscroll 1
defn InsightAnalysisDefinition 1
defn InsightVisualizationDefinition 1
nstopic ins_aboutidl insover:0120 "About IDL" 3
endnonscroll 3
nstopic ins_over2 insover:0130 "IDL Documentation" 3
endnonscroll 3
nstopic manualorganization insover:0140 "Manual Organization" 5
topicmacro CIB(chapter,PI("","nav_insover")) 5
endnonscroll 5
nstopic ins_over03 insover:0150 "Typographical Conventions" 6
endnonscroll 6
nstopic ins_over04 insover:0160 "Reporting Problems" 7
endnonscroll 7
nstopic GettingStartedWithInsight gettingstartedwithin:0100 "Getting Started" 11
topicmacro CIB(chapter,PI("","nav_gettingstartedwithin")) 11
endnonscroll 11
nstopic StartingInsight gettingstartedwithin:0120 "Starting Insight" 12
topicmacro CIB(chapter,PI("","nav_gettingstartedwithin")) 12
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defn DataandFilesDefinition 12
nstopic GettingStartedWithInsightDialog gettingstartedwithin:0130 "Using the Getting
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endnonscroll 12
defn inst02 12
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port Dialog" 13
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15
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face: Introduction" 16
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endnonscroll 20
nstopic PageSetUpMenuOption gettingstartedwithin:0270 "Page Set Up Menu Option" 20
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nstopic DataManagerMenuOption gettingstartedwithin:0280 "Data Manager Menu Option" 20
endnonscroll 20
nstopic PreferencesMenuOption gettingstartedwithin:0290 "Preferences Menu Option" 20
endnonscroll 20
defn inst11 20
nstopic ExitMenuOption gettingstartedwithin:0350 "Exit Menu Option" 20
endnonscroll 20
nstopic OtherWindows gettingstartedwithin:0390 "Other Visualization Window Menus" 21
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nstopic SettingPreferencesSection gettingstartedwithin:0400 "Setting Preferences Dialogs"
21
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endnonscroll 21
nstopic PreferencesDialogGeneral gettingstartedwithin:0410 "Preferences Dialog for Cus-
tomizing General Features" 21
endnonscroll 21
defn inst11 21
nstopic PreferencesDialogClipboard gettingstartedwithin:0412 "Preferences Dialog for Cus-
tomizing Clipboard" 23
endnonscroll 23
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